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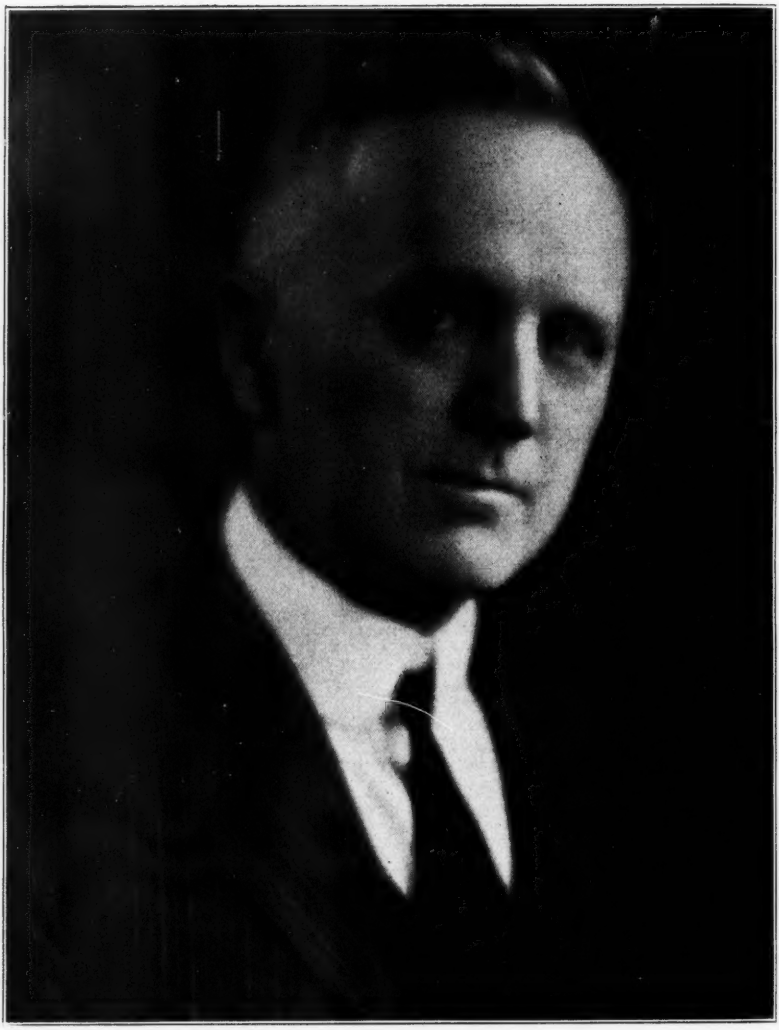

NEWTON G. THOMAS, D.D.S., Chicago, Ill.
Associate Editor of the American Dental Association

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THE JOURNAL
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Original Communications

THE CLOSED BITE RELATION OF THE JAWS OF GEORGE WASHINGTON, WITH COMMENTS ON HIS TOOTH TROUBLES AND GENERAL HEALTH*

By W. J. PRYOR, D.D.S., Cleveland, Ohio

IN early school days, the familiar Stuart painting of Washington (Fig. 1) "The Athenaeum Head" gazed down on me like a god from almost every classroom wall. I read the ridiculous cherry tree story, and the refusal-to-fight-in-his-younger-days yarn, by Weems, and formed in my youthful mind a "mythical Washington," to whom one could almost offer up his prayers, but whom one could not imagine being a resolute warrior and statesman.

My interest in artificial dentures has made it evident that something was radically wrong with the mouth portrayed in the Stuart painting. This portrait made during his sixty-fifth year shows Washington with a lack of proper facial dimensions owing to the loss of his teeth. The distance from the nose to the chin is too short and the concave contour of the lower lip is lost, the so-called "ape-chin," so common in neglected denture patients, resulting. This painting was so unlike Washington that his family refused to accept it, and Stuart's widow sold it years after his death to the Athenaeum Society of Boston. It is now in possession of the Museum of Fine Arts in Boston.

It is an indictment of our hit-and-miss culture that the Weems yarns should have become so entrenched in our traditions, and that the Stuart portrait should have been accepted for years and used as the official picture on United States currency and postage stamps. In more recent years, I have found that there exist life masks or molds of the head of Washington and portraits which depict him as the determined fighter, the deep thinker and yet kindly and human man that he was in reality.

Mercer, in 1760, when Washington

*Read before the Section on Full Denture Prosthesis at the Seventy-Fourth Annual Session of the American Dental Association, Buffalo, N. Y., Sept. 14, 1932.

was 28 years of age, alluded to Washington showing, when his mouth was open, "some defective teeth," and as early as 1754 one of his teeth was extracted. From this time on, toothache usually followed by the extraction of the offending member became almost of yearly recurrence, and his diary reiterates, with verbal variations, "indisposed with an aching tooth or swelled and inflamed gums," while his ledger contains many items such as "To Dr. Watson, drawing a tooth 5/." By 1789 (age 57), he was using false teeth, although his last tooth was not lost until 1795. "These substitutes were very badly fitted and when Stuart painted his famous picture, he tried to remedy the malformation they gave the mouth by padding under the lips with cotton. The result was to make bad worse, and to give in that otherwise fine portrait a feature noticeably poor and unlike Washington. . . . In 1796, Washington was furnished with two sets of 'Sea Horse' (hippopotamus) ivory teeth." They were better fitted than his previous ones and for a time the distortion of the mouth was less noticeable.

There is much evidence, both written and in his portraits, that, during the last twenty years of his life, Washington's jaws were progressing into a badly closed bite relation. Senator Maclay, in 1789, saw him as he really was. "His complexion pale, nay almost cadaverous. His voice hollow and indistinct, owing, as I believe, to artificial teeth before his upper jaw, which occasions a flatness." Also, in the same year, at one of the President's dinners: "He seemed in more good humor than I ever saw him, though he was so deaf that I believe he heard little of the conversation." This defect Washington also disclosed to Jefferson, saying that he was "sensible too, to a decay of his hearing." This defect we now know may have been caused or aggravated by the encroachment of the condyle of the mandible on the external auditory meatus, due to excessive closing of the bite. David Ackerson relates: "I saw him at Alexandria a year before he died. His hair was gray and his form slightly bent. He had false teeth, which did not fit and pushed his under lip outward."

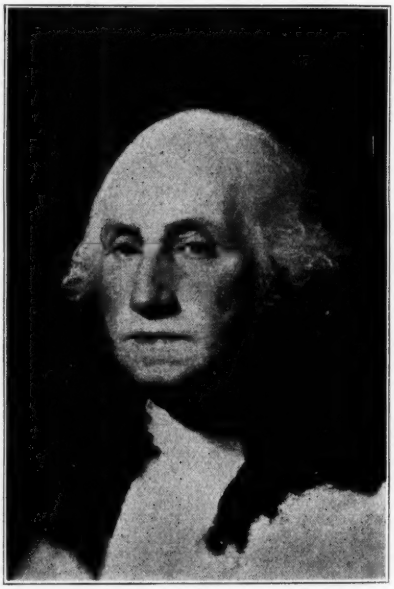

Fig. 1.—The Athenaeum head, painted by Gilbert Stuart, when Washington was 64 years of age. The facial dimension nose to chin is too short and the lips are padded with cotton.

These teeth, made by Dr. Greenwood of New York, were carved from ivory, the upper in two sections mounted by means of rivets to a wrought gold base. The lower was carved in three pieces, an ivory base to fit the ridge, and two tooth sections secured to the base by

means of wooden pegs. Gold posts were anchored to the buccal surfaces upper and lower to which were attached spiral wire springs that were supposed to retain the dentures in place.

These dentures (Fig. 2) are now in the possession of the Baltimore College of Dental Surgery. They were probably made in 1796, and in 1798 they were repaired by Dr. Greenwood, who, in a letter to Washington, described the method of repair, and enclosed a bill for $15. Washington apparently had been

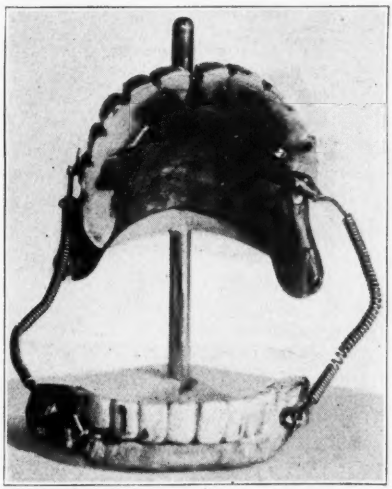

Fig. 2.—Ivory teeth mounted on gold base.

soaking his dentures in port wine to remedy an objectionable odor, a condition which any dentist can understand. He was cautioned in a letter from his dentist that this would discolor the ivory teeth. Paul Revere is credited by some with having made one of the earlier partial dentures worn by Washington, but this story is not supported by the records.

Let us pause here to consider that the most lowly charwoman of today can for a few dollars, possess artificial teeth far superior to those that Washington had to put up with, only a century and a third ago, and yet he was the most famous and one of the wealthiest men of his time. What better evidence of the progress made by dentistry can be found? The following announcement by Greenwood shows our progress in another direction, "Dentist to his Excellency, Geo. Washington, late President of the United States of America, No. 15, opposite the Park, New York, near the theatre."

It is recorded that no artist was able to portray Washington as he really was. Most of the portraits of Washington are idealistic and stress certain characteristics which appealed to the artist. The particular style of the individual artist can be traced in their different efforts. Stuart liked to impart to his subjects a "certain venerable and benign appearance." The Athenaeum head (Fig. 1) appears to be that of an "elderly, grandmotherly individual." Stuart was the most famous artist to paint Washington, and while his portraits have great merit as works of art, the likenesses were in all probability not good, as they do not check with the measurements of the life masks made by the Frenchman Jean Houdon.

The portrait made the year before (Fig. 4), which was apparently satisfactory to the Washingtons, is a fine picture also, but in this the nose is too short and the distance from nose to chin too great. Stuart apparently overdid the bite opening operation with his brush here. The mate to the Athenaeum head, that of Martha Washington (Fig. 3), is a work of art. In this picture of Martha, we suspect the artist produced a result equivalent to face lifting.

Stuart often complained of Washing-

ton's impatience at posing for his sittings, and there is evidence that Washington was not fond of Stuart. This attitude may have made it difficult for the artist and "recommends to us the advantages of photography."

The first time that Washington was drawn, he wrote to a friend:

> Inclination having yielded to Importunity I am now contrary to all expectation under the hands of Mr. Peale; but in so grave—so sullen a mood and now and then under the influence of Morpheus when some critical strokes are making, that I fancy the skill of this Gentlemen's Pencil will be put to it, in describing to the World what manner of man I am.

This passiveness seems to have seized him at other sittings, for, in 1785, he wrote to a friend who asked him to be painted:

> In for a penny, in for a Pound, is an old adage. I am so hackneyed to the touches of the painter's pencil that I am now altogether at their beck; and sit like Patience on a monument, whilst they are delineating the lines of my face. It is a proof, among others, of what habit and custom can accomplish. At first I was as impatient at the request, and as restive under the operation, as a colt is of the saddle. The next time I submitted very reluctantly, but with less flouncing. Now, no dray-horse moves more readily to his thills than I to the painter's chair.

Fig. 3.—Portrait of Martha Washington painted by Gilbert Stuart.

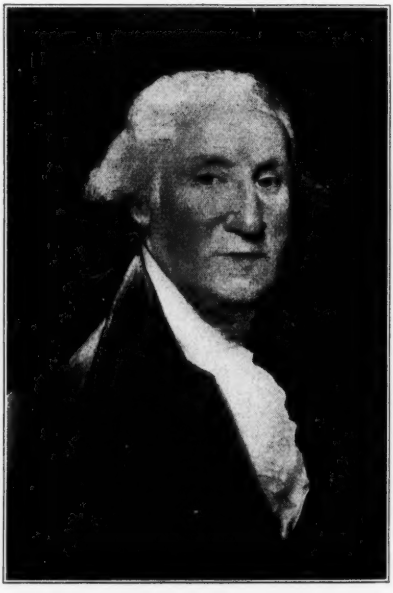

Fig. 4.—Less well known portrait of Washington painted by Stuart. Washington was at the time 63 years of age.

The life masks by Houdon, made when Washington was 53, show a strong face and provide accurate measurements with which to check the different portraits. They record slight closing of the bite and were undoubtedly touched up, as most all of the paintings show a bump on the upper part of the nose, which is virtually missing in the life molds.

In October, 1785, Jean Antoine Houdon, a Frenchman, traveled to Mt. Vernon to make these life masks (Figs. 5-6). Coming up the Potomac, he arrived at midnight, and he started his work the next morning. Washington was much interested in Houdon's work, and writes that he carefully watched the method of handling the plaster and instruments during the few days of Houdon's stay. The life size figures on which reproductions of these masks were used are not good as works of art, the full length portraits by Peale and Trumbull being much superior as records of Washington's physique.

The paintings of Edward Savage (Fig. 7) all stress Washington's closed bite jaw relation and bring out a marked protrusion of the chin not present in the life mask records, made eight years earlier. The Savage portraits, while stated by some to be the truest likenesses of Washington in existence, most certainly do not check with the life mold measurements, the noses being 15 to 20 per cent too long.

The portraits by John Trumbull, a lifelong friend and companion at arms of Washington, all show an expression about the eyes not seen by the other artists. While no doubt an idealization, the head painted in 1793 is a fine portrait (Fig. 8). Trumbull's full length paintings made at a much earlier date are probably the best of this type. They

Fig. 5.—Left: Bust of Washington taken from life at Mount Vernon, Oct. 7, 1785, by Jean Antoine Houdon, and now at Mount Vernon. Right: Life mask of Washington taken at Mount Vernon in October, 1785, by Jean Antoine Houdon, and now in the Pierpont Morgan Library, New York City. Washington was at this time 53 years of age.

record the same facial expression, although the features are more rugged.

While a number of other artists painted Washington, it remained for James Sharpless to reproduce for posterity portraits which tell in their expression the story of Washington's powerful character. Sharpless was not a famous portrait painter and left behind but little of his work. Although he came from a family of artists whose work was mainly landscape, his portraits check very closely

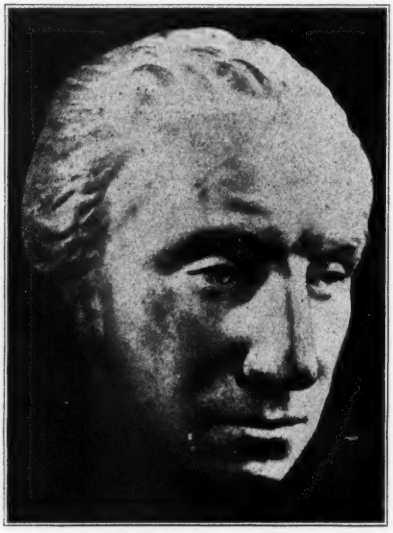

Fig. 6.—Life mask of Washington at the age of 53. This mask was made by Houdon.

with the Houdon molds, and it is said that he took careful measurements before starting his work. It might be well to say here that the dentist who gets fine results does the same thing at the start of his work. The three-quarter Sharpless portrait (Fig. 9) is a great character study. Strong determination and perseverance are expressed in the straight, firmly closed lips and powerful jaw. The sloping forehead indicates quickness of perception and decision. The large Roman nose is a sign of the born leader with force and the ability to command. The widely separated eyes are those of the deep thinker. The head is that of a great fighter and thinker combined.

The fine profile radiates kindness and patience (Fig. 10). It also shows some closing of the bite when compared with the life molds. It is, I believe, the best likeness of Washington in existence. These Sharpless portraits should have long ago been made the official Washington pictures, the pictures that children should know him by. A step in the right direction is shown in the use of the Houdon profile on 1 cent postage stamps and the 1932 twenty-five cent pieces.

Picture this head upon the shoulders of a powerful, angular yet graceful figure 6 feet 2 inches in height and you see the strong, determined man who was the leader and guiding genius in the founding of this republic.

During the Revolutionary War, Washington was in the prime of life and possessed great endurance and strength, being at times on horseback almost twenty-four hours at a stretch, and for days at a time. At this period, he was a heavy eater of plain foods and took a glass of rum or whiskey before breakfast. He had large feet and hands, the joints of the fingers being remarkably large. It is related that to place his great tent on an army wagon was the work of two ordinary men, but Washington could do this himself with little effort. He was always an expert horseman and is described by several historians as having an erect, dignified and graceful bearing.

Figure 11 has great merit as a work of art. It is a reproduction by Rem-

brandt Peale of a painting made by him in 1795, the original having been destroyed by fire. This portrait resembles the Stuart painting to such an extent that there is a suspicion of the influence of Stuart's work on this reproduction.

Figure 12, also by Rembrandt Peale, is an idealization painted years after Washington's death. Both these portraits show the cotton packed lips seen in the Athenaeum head.

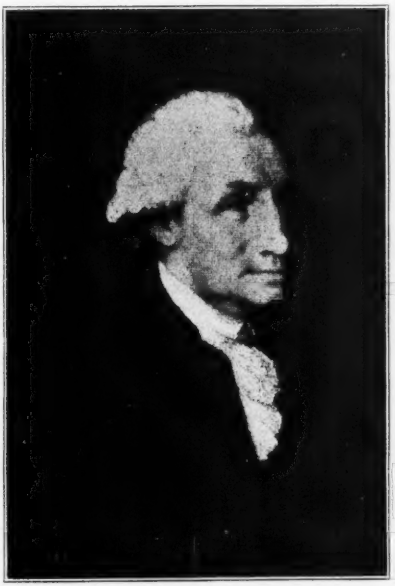

Fig. 7.—Portrait of Washington at the age of 61; painted by Edward Savage.

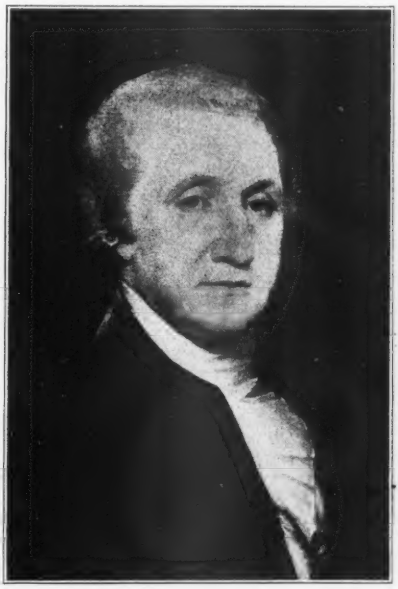

Fig. 8.—Portrait of Washington at the age of 61; painted by John Trumbull.

Figure 13, by Charles Wilson Peale, father of Rembrandt Peale, was painted when Washington was 51. No closing of the jaw relation is seen here. The concave contour of the lower lip, so difficult to maintain in some denture patients, is nicely shown. The maintaining of this curve in the lower lip is a strong argument in favor of retaining the natural anterior lower teeth as long as possible, especially in women patients, who value facial appearance so highly.

Figure 14, an etching, also shows the deformity of the mouth caused by the wearing of ill-fitting dentures. There is some little doubt as to whose work this is.

It may not be out of order to relate here some of the illnesses which Washington's sturdy constitution had to fight off, as it sheds light on the medical and dental knowledge of the time. There is no record of childhood diseases, although he no doubt had his share of these, but, at the age of 19, he accompanied his brother Lawrence, who was a victim of tuberculosis, to the West Indies for his health. In the light of today's knowledge, he would have to better advantage taken him just a short distance to the

Carolina mountains to rest and recuperate in the clear mountain air, rather than to the debilitating heat and humidity of the tropical islands. Lawrence Washington died shortly after returning home.

While in the West Indies, Washington accepted an invitation to dine at a friend's home, but with reluctance, since there was smallpox in the family. In ten days, he was taken violently ill with smallpox, the effects of which troubled him until long after his return to Virginia.

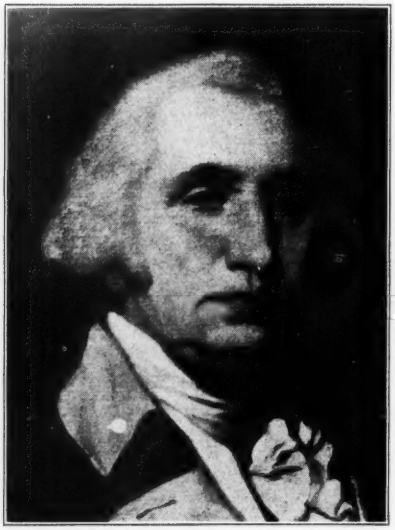

Fig. 9.—Portrait of Washington painted by James Sharpless.

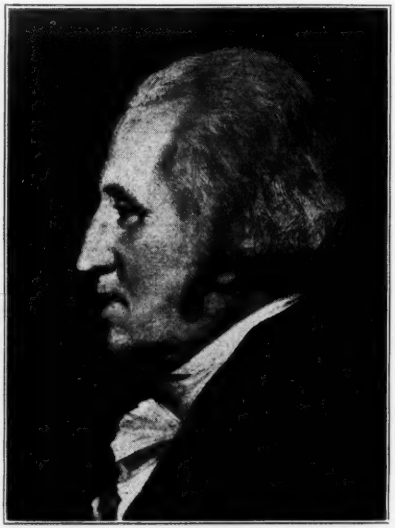

Fig. 10.—Profile portrait of Washington painted by James Sharpless.

This incident indicates a recognition of the danger of contracting the disease, but, at the time, this knowledge was yet not translated into action, in the form of preventive medicine by the use of quarantine. Washington was badly pockmarked, and carried a dread of this disease into his later life, when he worked unceasingly in its prevention. When smallpox was decimating his Continental army, he fought before the Virginia assembly for permission to have his men inoculated, it being against the law in that state.

He sought for several years to persuade Mrs. Washington to submit to inoculation before she would agree to do so. Inoculation produced a mild form of smallpox, rendering the patient immune, but had the bad feature of being contagious. Jenner's discovery of vaccination eliminated this bad feature of preventive measures for us.

On the frontier, in 1757, Washington was seized with a severe attack of dysentery and fever, which forced him to leave his army and retire to Mt. Vernon. He wrote, three months later, "I have never been able to return to my command, my disorder at times returning obstinately upon me. My constitution is

certainly greatly impaired, and . . . nothing can retrieve it, but the greatest care and the most circumspect conduct."

In 1761, he was attacked with a disease common to new settlements, known in Virginia at that time as "river fever," and later on, in the west, as "break-bone fever." This disease, known today as malaria, is checked by the specific quinine, a pure water supply, etc.

During the Revolution, Washington

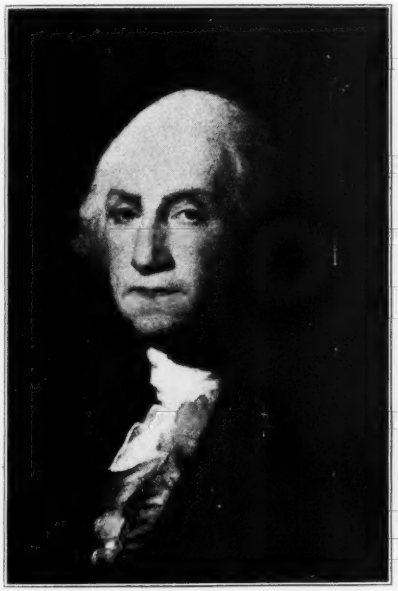

Fig. 11.—Portrait of Washington at the age of 63; painted by Rembrandt Peale.

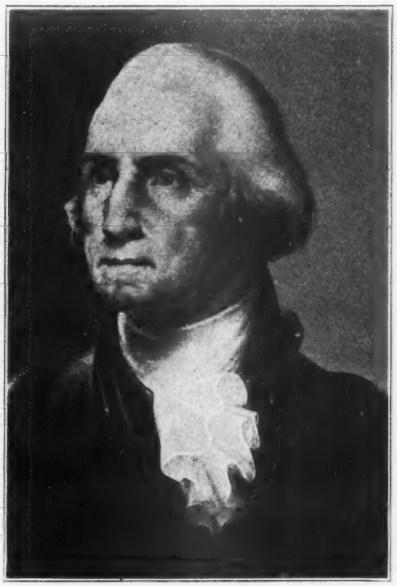

Fig. 12.—Idealistic portrait of Washington, the work of Rembrandt Peale. Both this portrait and the one presented in Figure 11 show the distorted mouth.

was comparatively free from sickness. After his return to Mt. Vernon, his old enemy, "the ague," returned, and he says in a letter, "I write to you with a very aching head and disordered frame."

In 1787, he wrote, "A rheumatic complaint which has followed me more than six months, is frequently so bad that it is sometimes with difficulty I can raise my hand to my head or turn myself in bed." No doubt the roentgen rays of today would have indicated the extraction of his few remaining teeth. Woodward, one of his biographers, wonders if Washington's bad teeth did not have much to do with his ill health.

On his tour of New England in 1789, he was stricken with influenza. The epidemic prevailing in Boston shortly afterwards was humorously called "Washington influenza." Six months later, in New York, he was overtaken by an infection so severe that his life was despaired of. McVickar describes this illness as a "case of anthrax." From the description, it is more likely that it was a case of Ludwig's angina, or an abscess

traveling from the mouth along the fascia down the neck.

Washington's medical knowledge and opinions are very interesting as they reflect the knowledge of his day. Reading Washington's letters and his biographies leaves one with the impression that he had a turn of mind for doctoring. As plantation life made necessary a certain amount of "physicking," Washington's yearly invoice to London always included a variety of drugs and patent medicines, as well as remedies for dogs and horses, all of which have long since been forgotten. More unenlightened was a treatment prescribed for Patsy Custis by Joshua Evans, "who came here last night, put a (metal) ring on Patsy (for fits)." Washington's diary at another place records his sending for Dr. Laurie to bleed his wife. The doctor, "came here, I may add, drunk" the diary notes, so that a night's sleep was necessary before the service could be rendered. He seemed to be particularly partial to the practice of bleeding, which was popular at the time, and his instructions to his overseers went into detail in prescribing treatment to be given his slaves for even minor indispositions, although he hired a doctor by the year to take care of this work. Tourists are shown some surgical and dental instruments, bleeding knives, etc., as having been owned and used by Washington.

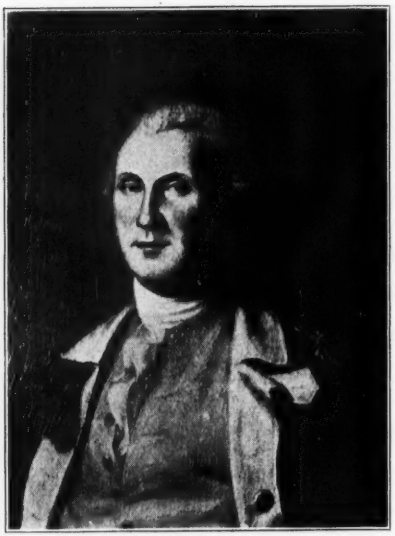

Fig. 13.—Portrait by Charles W. Peale, painted when Washington was 51. No distortion of the mouth is apparent.

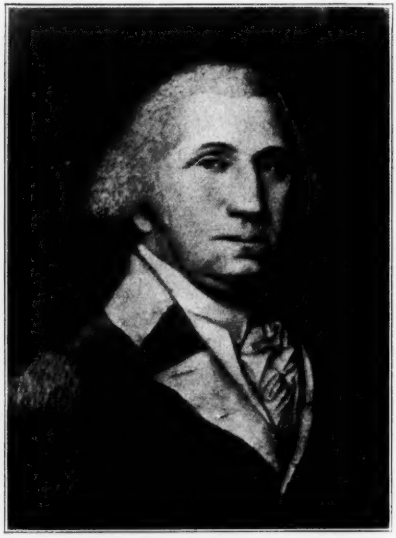

Fig. 14.—Etching of Washington, the work of an unknown artist, showing the distorted mouth.

When smallpox broke out among his slaves, he relates that he hurried to them, went into their quarters and saw to it that they were properly treated.

(Washington dabbled in dentistry to this extent. He did possess some dental instruments and did work at adjusting the clasps of his artificial teeth and tinting the ivory gums with wax. About six years ago, A. Alfred Nelson, of Detroit,

invented a wax to be used for the same purpose. It was a new idea to this generation of dentists and was marketed under the name of "tissue blend." Washington was 125 years ahead of us in this respect.

Also Washington's diary of Monday, October 10, 1785, describes the preparing of plaster of Paris, its handling, mixing, setting-time, behavior, instruments used, etc., so carefully and in such detail that it could be used as a lecture on the subject to freshman dental students.

This day's diary entry is very interesting, as some prosthetists use life mask records to check changes in the facial dimensions of their artificial denture patients. Washington was interested in life mask work at the time and the technic he described for handling the plaster is so excellent that it has not been improved on.)

In view of such examples of medical practice and the treatment given Washington in his final illness and which probably caused his death, it is difficult to understand some of our modern writers who take great pains to deride the medical knowledge of the so-called "dark ages." The treatment referred to which had Washington's approval was as follows: On becoming seriously ill, he sent for an overseer and ordered the man to bleed him and about half a pint of blood was taken. Subsequently, he had two more "pretty copious bleedings," and finally a fourth, "when about 32 ounces of blood were drawn." This was done against the advice of one of the doctors in attendance. Shortly after this, Washington became weaker and died.

In conclusion, let me call your attention to the desirability of taking and recording accurate facial measurements before constructing dentures, and to the necessity of periodic inspection of artificial denture cases. Following this practice, proper action can be taken to maintain correct jaw separation, thereby insuring the retention of the natural facial dimensions. Too many of these closed bite cases are seen today, owing to neglect by either the patient or the dentist, but leaving room for educating the public to the fact that this condition is correctable.

Too many cases of "ape-chin" are encountered because, with our present knowledge of preventive dentistry, there is less need of losing the lower anterior teeth than any others in the mouth. They are less subject to decay and most easily reached for prophylactic treatment, but are frequently lost owing to the patient's ignorance or neglect.

It is said that Washington cursed at his inability to eat with his artificial dentures, and after we have inspected them, he has our whole hearted sympathy. Quoting from Garland:

> Some say Washington was not nice—he swore when he became angry! Others say —and may Heaven and Volstead defend us —that he drank whiskey before breakfast! And still others say that Washington—after spending the greater part of forty-five years without pay in the service of his country, after wresting its independence from Great Britain, after establishing a stable form of government, and building a great nation—was not even an American! Indeed, our great men are few and far between while the fools we have with us always.

We can be thankful for the natural appearing and functioning artificial teeth procurable today, which contrast so favorably with those of Washington's day, but let us strive unceasingly to improve them. With our present knowledge of preventive dentistry, the wearing of artificial dentures should seldom be necessary, but we will always have with us those who neglect and lose their natural teeth through either economic necessity or laxness in their care.

1020 Rose Building.

DISCUSSION

H. V. Cottrell, Columbus, Ohio: Dr. Pryor has ably observed the lines of Washington's face and has no doubt come to a correct conclusion when he ascribes to the presence of dentures, cotton, etc., the responsibility for the lines depicted by some of the artists. He has very appropriately called to our attention the fact that certain measurements of faces should be made before the loss of teeth, if we are to restore facial lines accurately. If such measurements or photographs were used, we would observe, in the course of time, that, for the cases not presenting such records, we were setting anterior teeth too nearly directly over absorbed ridges. The alibi, of course, is "less leverage"; while the result is a sacrifice of esthetic values, destroying partially, if not wholly, the concavity of the lips as viewed in profile. It is interesting to note that the observations on Washington's character, supposedly suggested by the physiognomy, are made to correlate perfectly with history. We would be much interested in knowing what the basis for such discernment of character would be if history were blotted out. Some might differ in regard to character indices here and there, such as that great width between the eyes indicates the deep thinker; rather it is present when the person is able to perceive form accurately.

Dr. Pryor: I have tried to bring out that if one were to judge Washington by observing the Athenaeum head and other of his portraits, he would not suspect the greatness of the man's character, but that a study of the Sharpless portraits would indicate that the subject did possess a powerful character. After reading several physiognomist's works, I am left with the impression that small eyes placed closely together indicate quick and crafty thinking and that more widely separated eyes indicate the more deliberate thinker. Some authors say that eyes placed more than the width of an eye apart are a sign of weakness.

After the reading of this paper, there appeared in newspapers stories in regard to Washington's teeth which grossly misquoted me. Without taking the trouble to find out who was responsible for these wild "wisecracking" statements or requesting a copy of my paper, Mr. Sol Bloom, congressman from New York and associate director of the Washington Bicentennial Commission, issued a special "press release" taking me to task severely for making statements which were only products of the imagination of news writers. After qualifying his statements, with the word "if," which, of course, the newspapers paid no attention to in their subsequent stories, I was accused by him of being guilty of fabrications and distortions of historical facts. He listed the following six items and very sagely answered them: 1. That Paul Revere made a set of false teeth for General Washington. 2. That Washington wore this set of teeth while crossing the Delaware. 3. That the teeth were set in a wrought gold base. 4. That Washington's false teeth kept his "mouth agape" and prevented him from closing it. 5. That Dr. Greenwood advised Washington to soak his teeth in port wine. 6. That Washington practiced dentistry on his slaves. Five of the six statements were not made by me at all as a careful reading of the paper will show and are too silly to answer. Statement No. 3 I *did* make and I stick by it. The upper teeth in the only surviving set of teeth which we *know* to be genuine are riveted to a wrought gold base. A recent letter from Ben Robinson, of the Baltimore College of Dental Surgery, who is the custodian of these teeth, confirms this contention. So the great congressman and his "historical experts" that he speaks of will have to correct their own records. He states, "One or more of the sets of teeth have survived and disprove the statement about the gold base, as does the correspondence." I would also like to know how many one or more are, if they are genuine and where they are kept. I am particularly indebted to Mr. C. M. Garland, author of a fine book, "Washington and His Portraits," for the cuts of Washington's portraits, also to Paul Leicester Ford for information assembled in his work, "The True George Washington." The following works were read or referred to in approximately the order in which they are listed:

C. M. Garland: Washington and His Portraits.

Regent's Edition: Washington's Diaries.

Paul Leicester Ford: The True George Washington.

Worthington Chauncey Ford: Writings of Washington.

Lucretia Terry Osborn: Washington Speaks for Himself.

W. E. Woodward: George Washington.

Washington Irving: Life of George Washington.
Woodward Wilson: George Washington.
Rupert Hughes: George Washington; the Human Being and the Hero.
Shelby Little: George Washington.
Louis Martin Sears: George Washington.
S. Weir Mitchell: The Youth of Washington.
Mrs. Roger Pryor: Mother of Washington.
Henry Cabot Lodge: George Washington.
Weems: George Washington.

SURGICAL PREPARATION OF MOUTHS FOR THE RECEPTION OF ARTIFICIAL DENTURES*

By GEORGE C. PIKE, D.D.S., Chicago, Ill.

ALTHOUGH the surgical preparation of mouths for the reception of artificial dentures has been practiced by exodontists and oral surgeons for a number of years, it is one phase of the practice of dentistry that receives little or no attention from the general practitioner.

Wilton W. Cogswell has said:

> To prepare dental ridges correctly by the removal of all remaining teeth and by surgical manipulation of the investing structures, the operator must be thoroughly conversant with the factors in successful denture retention. Perhaps it might be well to say that, at times, he should be called on to carry out the steps of the modern denture technics and construct a full denture for the foundation which he has prepared. It would at least reestablish in his mind the importance of his work and perhaps diminish therein the importance of spectacular surgery in favor of conscientious recognition of the value of tissue control and repair.

Since the majority of dentures are made by the dentist in general practice, it would seem that more men should be interested in the proper preparation of the mouths of their patients. The reluctance of so many dentists to attempt this type of surgical work is unfortunate and doubtless has arisen from the unsatisfactory results ensuing when it is improperly or carelessly performed.

That there is an actual need for this type of service is no longer a question. The only doubt seems to be as to when it should be done and how much surgical interference will improve a given case. The answer to the question obviously varies with individual cases and can be answered only after careful examination and due consideration of the existing mouth conditions. The examination should always include roentgenograms of all teeth and tooth areas, if for no other reason than the protection of the dentist. It is true that not all mouths contain pathologic areas, but the omission of a radiodontic examination may result in unsatisfactory denture service.

To illustrate: A patient having worn dentures for several months complained of soreness in the region of the maxillary molar area. On examination, the teeth on that side of the denture seemed to be striking harder than on the opposite side. The teeth were ground in and balanced as had previously been done.

*Read before the Section on Full Denture Prosthesis at the Seventy-Fourth Annual Session of the American Dental Association, Buffalo, N. Y., Sept. 14, 1932.

Three weeks elapsed and, on returning, the patient presented the same condition as on the first visit. A mouth examination revealed only a very slight bulge in the left tuberosity area, but the radiodontic examination disclosed an unerupted maxillary third molar. After removal of the third molar, relining of the denture was necessary. An intelligent patient might wonder why such a tooth was not removed before the dentures were made.

In another instance, a woman, having worn dentures successfully for three years, during the last year of which she had spent considerable time and money for treatment of the right maxillary sinus, presented a slight soreness over the maxillary right cuspid area. Radiodontic examination disclosed a portion of the right lateral root with some evidence of infection present. The removal of this root ended the soreness in the cuspid region and the sinus trouble did not recur.

The clinical examination of a mouth for the purpose of denture construction should include a careful consideration of retention, jaw relation, articulation, anatomic structure and esthetics. Experience, ability and equipment vary with different operators, and it naturally follows that ideals will not be the same. It is generally agreed that an ideal mouth for the reception of artificial dentures would present the following conditions: The jaw ridges should be in a normal relation to each other, and the individual ridges should have regular occlusal planes, free from variation in height; the ridges should be smoothly rounded, with no undercuts present and no sharp ridges or spicules, and the muscle attachments should be in their usual positions.

Leo Winter has classified anomalies requiring surgical correction as: "1. Abnormalities and mutilation of the alveolar process and of the palate necessitating alveolectomy. 2. Hypertrophied tissue and flabby tissue. 3. Abnormal labial frenums and other muscle attachments."

This classification comprehends the following indications listed according to their frequency of appearance: sharp spicules protruding from the alveolar process; gross tuberosities presenting undercuts on the buccal surfaces; tuberosity areas that are enlarged in the vertical direction; alveolar ridges having prominent undercuts on their buccal or labial aspects; variations in the height of ridges; a combination of short upper lip and a maxillary ridge of unfavorable length; pronounced protrusion of the maxillary ridge; an occlusal plane of the maxillary ridge too low in the posterior part of the mouth to permit of proper articulation of the artificial teeth; a maxillary ridge considerably larger than the mandibular ridge; muscle attachments or frenums in abnormal positions, and torsus palatimus or torsus mandibularis.

In the mouths of patients who have previously worn artificial dentures, one may also encounter ridges composed largely of flabby connective tissue or hypertrophied connective tissue in the valve producing areas. The removal of such obstacles will enable the operator to render a more satisfactory denture service.

It is well to keep in mind the fact that the improvement of unfavorable cases can be accomplished only through the destruction or elimination of excess tissue. The types wherein a great excess of tissue is present are the ones in which the most pleasing results are obtained; while in those cases in which the

ridges are in an abnormal relation to each other and do not have much bulk but are thin and spinous, little surgical assistance can be given.

In the establishment of an even occlusal plane, the height of the ridge can be changed only by lowering it. The building up of ridges has not been satisfactorily demonstrated as yet. The most frequent discrepancies in the occlusal planes are found in the region of the maxillary third molar or tuberosity areas, and in the region of the mandibular anterior teeth. If either of these areas are out of normal relation, the havoc played with tooth arrangement is obvious. Occasionally, one finds a thin spinous mandibular ridge that may present a favorable occlusal plane but in which rapid resorption may be expected. Experience has taught us that it is better to reduce the level of such ridges to a point where the denture will have a foundation of solid bone structure even though some retention is apparently lost. The removal of large tuberosities, while looking somewhat formidable, is really quite easily accomplished.

Normal muscle attachments rarely require surgical interference, but where false attachments have been formed by scar tissue, they should be clipped and the edges sutured to prevent reattachment. The same principle applies to an abnormal labial or lingual frenum. Superfluous soft tissue is most frequently met with in edentulous mouths, but wherever present, it should be removed before impressions are taken, simply by anesthetizing with procaine and excising the fibrous areas and subsequently suturing the edges.

In the practice of general dentistry, the prosthodontist is usually the exodontist as well, and the alveolar process must receive surgical attention where indicated if satisfactory denture service is to be expected.

According to Leo Winter: "Among the members of the dental profession, it has become axiomatic, given edentulous maxillary and mandibular ridges of normal height, health, width and contour, that, with the exercise of reasonable skill and accuracy, a set of esthetic, serviceable dentures can be constructed."

These operations can and should be part of every practitioner's routine, as they can be performed under local anesthesia and with but little discomfort to the patient. The only precautions to be observed are those of surgical asepsis and avoidance of rounding or tapering the buccal and labial plates of bone more than is desirable. The best denture retention is effected by leaving the buccal plates more nearly parallel than by tapering them, so that the ridge takes on a flattened appearance. Too large a case should not be attempted in the beginning. It would be wiser to divide the arch into sections and operate on only one section at a time.

The last and probably the most important precaution to be observed is to avoid so frightening the patient by talking about the operation that he may refuse to go on with it. Obviously, if the dentist is himself afraid of the operation, that fear is sensed by the patients to such an extent that, in some cases, they will not submit to the procedure. If patients are treated as if they were to undergo a simple extraction and the same amount of confidence is displayed by the dentist, excellent results usually follow.

There are two procedures that may be followed. The first is the plan of extracting the teeth and removing any excess tissue and process at one sitting.

When the patient's business or social engagements will not permit him to be without teeth for more than a very short time, this is the plan to follow. Assuming that a number of the upper teeth are present, but are in such condition that they must be removed, and that there are bony eminences which require removal, we would advise the following procedure: As nearly as possible, an aseptic condition should be created in the mouth. This may be done by thoroughly cleaning the teeth and washing the mouth with an antiseptic solution. Injection is made with a local anesthetic solution in the same manner as for extraction, the operator being sure to include all tooth areas that he desires to work on. Then, before extraction, an incision is made from the third molar to the cuspid through the gum tissue and periosteum along the buccal surface at the gingival line so that as much as possible of the interproximal tissue is attached to the buccal flap. Starting in the cuspid region on the labial surface, an incision is made through the interproximal tissue so that no interproximal gum tissue remains on the labial flap. When the opposite cuspid is reached, the continuing incision should again permit the retention of the interproximal gum tissue.

We must be sure that the incision has passed completely through the periosteum to the bone, and, if necessary, must go over the same incision a number of times to insure this. With a periosteal elevator, we lift the periosteum and gum tissue, which is called the mucoperiosteal flap. When the opposite cuspid is reached, gentle pressure to avoid stretching or tearing the tissue at right angles to the incision, we continue exposing the process to a point about two thirds of the length of the root. If hemorrhage becomes annoying at this point, it may be arrested by applying gauze packs and pressing the mucoperiosteal flap back to its normal position and maintaining pressure there for a moment. Now, we make a similar incision along the gingival line on the lingual surface of the ridge, saving the interproximal tissue in the posterior portion of the mouth. The lingual tissues need not be separated from the bone for more than about 5 mm. as the anatomic structures rarely need correcting on the lingual surface. If easier access is desirable later, the separation started before extraction can be continued without difficulty.

At this point, the teeth should be removed, and if many are present, it will be more convenient to work on both posterior sides of the arch before extracting the anterior teeth. In this way, some bothersome hemorrhage may be avoided until the most inaccessible portions are cared for. Then too, the anterior teeth provide a convenient rest for the operator's hand. Now, we make the desired changes in the osseous structures by removing the greatest excess of tissue with rongeur forceps and finishing with a bone file to insure smoothness. If care is exercised and all loose pieces of bone are removed as the operation progresses, washing of the wound will be unnecessary. When both posterior portions have been trimmed to our satisfaction, the anterior teeth should be removed and the ridge trimmed in a similar manner.

The examination to determine whether or not a sufficient amount of bone has been removed can be made most readily by replacing the mucoperiosteal flap in its normal position and palpating with the fingers. When the posterior teeth have been out for some time, excessively large tuberosities sometimes develop.

These are composed chiefly of fibrous connective tissue and, in some cases, reach a thickness of almost a centimeter. Probing with a sharp explorer will usually inform the operator as to the type of tissue these are composed of before the incision is made. If the correction can be made at the expense of connective tissue only, it should be dissected out from under the mucosa without disturbing the osseous structure. In some cases, where objectionable undercuts make advisable the removal of much bone from the buccal surface of a tuberosity, a portion of the lateral wall of the sinus may be accidentally removed. If care is taken not to puncture the periosteum and lining of the antrum, no harm will be done and a new wall will regenerate. This is not likely to occur if teeth are present in the region.

The constant use of gauze sponges to arrest objectionable hemorrhage will tend to keep the field of operation clean, and if the patient is asked to bite and hold one or two sponges in place over the ridges just prior to the insertion of the sutures, a cleaner field of operation will be assured. If there is an excess of mucoperiosteal tissue when the edges are brought into adaptation, it may be cut off with scissors. A serrated edge on the scissors will prevent the slipping of the tissue from the points. Horsehair or prepared silk sutures have proved to be most satisfactory in my hands and are best placed with a No. 18 half circle needle. Interrupted sutures should be placed sufficiently close to hold the tissue in close adaptation without any attempt being made to stretch the tissue or the sutures will cut themselves out. These sutures should be permitted to remain for five days before removal, and complete healing may be expected in from two to three weeks. Dentures may even be inserted before complete healing has taken place.

Before dismissal, the patients should be told that he must expect pain for two to three days after the operation. They should be warned, too, that there may be considerable swelling, which can be prevented to some extent by the immediate use of ice packs, which should be continued for at least two hours after the operation. Since bleeding in the tissue sometimes occurs with its resultant black and blue marks about the mouth, it is best to prepare patients so that they will not be alarmed when this does occur. Postoperative mouth care by the patient should be prescribed for in the way of analgesics or hypnotics and the use of a mild antiseptic mouth wash. For the benefit of those who have had little experience with this type of operation, should the patient return to the office unexpectedly after two or three days with the face greatly swollen, I would say that there is no need to be alarmed as these conditions subside quickly and cause surprisingly little pain.

The second, and in my opinion by far the best method of procedure, is to extract the teeth at one sitting and wait until the mouth tissues are in a more favorable condition before trimming the process. This usually requires about three weeks. One is likely to provoke unnecessary discussion with a patient in trying to explain the advisability of such an operation, but if the history is known and the operator feels that six weeks without teeth will not inconvenience the patient too greatly, the situation may be tactfully handled by merely asking the patient to return three weeks after the extraction for a check-up examination and, at this time, the operation may be finished. The momentary displeasure to

the patient does not compare with the mental anguish caused by three weeks of worry and anticipation. While this method of handling the case is in a sense deception, it will save the patient so much mental suffering that the operator could hardly be criticized.

The operation or process resection in the edentulous mouth is much simpler, as the following description will indicate. We anesthetize all areas needing correction in the same manner as for extraction; then, make an incision along the crest of the ridge, using care as in the first method to have the lancet cut through all tissues to the bone. With a periosteal elevator, we lift enough of a mucoperiosteal flap that access to the process is gained. If only a small sharp spicule is to be removed, the incision need not be made long, but only of sufficient length that no tissue will be torn. The removal of such a spicule is effected by sliding a small flat bone file beneath the raised flap and smoothing off the process. If the entire buccal and labial surface of the jaw ridge needs reducing, one long incision extending along the crest of the ridge from tuberosity to tuberosity is all that is needed. One thought I wish to convey here is that at no time is it advisable to make an incision at right angles to the crest line of the ridge. The reason for this is apparent when one realizes that the oral mucosa is closely attached to the periosteum over the ridges, while, in the region of the buccal fold, the two tissues are very loosely attached to each other. To proceed: we expose the process and remove the gross protruberances with the rongeur forceps wherever access to the region is sufficient. In some instances, when the patient's mouth is open wide enough to give access to the tuberosity areas, the coronoid process of the mandible will prohibit the use of rongeur forceps. In a case of this type, the use of a file will prove very satisfactory with but little extra effort.

The process should then be smoothed with a bone file and any surplus tissue removed from the mucoperiosteal flaps before they are sutured into their proper relation, only enough sutures being used to hold the tissues in place.

The advantages of making a separate operation of the process resection, or what is commonly known as alveolectomy, are of sufficient importance in my opinion to outweigh the disadvantage of the extra time required.

Some of the advantages are as follows: Infection around the roots of teeth is permitted to clear up before the periosteum and bone are exposed. The normal resorption rate in that particular mouth may be observed and will act as a guide as to the amount of tissue that it is necessary to excise. The amount of objectionable or excess tissue is much more apparent than when the teeth are present. Tooth sockets have been filled with granulation tissue, and the removal of the buccal or labial plate of bone does not expose open alveoli and the ridges of interproximal septums, which always occurs in the case of the immediate process resection following extraction. The operation is more quickly and easily performed, is comparatively bloodless and causes much less trauma, with resultant diminishing of postoperative pain. The most important advantage is the one most apparent, and that is the almost total absence of resorption occurring in cases that have been treated in this manner.

Having followed through many cases of both types, I believe that, as in many other lines of endeavor, quality is sacri-

ficed where speed is gained, and only a careful and unhurried operation is productive of the most satisfactory results.

Wilton Cogswell says:

It must be constantly borne in mind that the efficacy of either the surgical or the denture technic may not be judged by the immediate results of wearing dentures, but rather by the length of time there is functional efficiency of both the dentures and their foundations. The success of the technic is dependent on that of the other, with the patient at the mercy of both.

DISCUSSION

Leo Winter, New York City: The movement that is now manifest in the dental profession throughout the country to widen the scope of practice of the general practitioner of dentistry is a sign of healthy development. In a paper, on alveolectomy,[1] read in 1930, I made a plea for a wider adoption of surgical preparation of the mouth for denture service, a plea which is brought again to our attention in the opening remarks of Dr. Pike. We note here that the dentist assumes the rôle of prosthodontist and exodontist and is assigned also the part of oral surgeon or alveolar surgeon. And justifiably so. Since the "larger percentage of dentures are made by the dentist in general practice," it would seem that "more men should be interested in the proper preparation of the mouths of their patients." Our knowledge of present-day prosthesis compels us to agree with the general thesis that there is a place for the surgical preparation of the mouth for the reception of artificial dentures. Dr. Pike raises two fundamental questions that naturally follow his premise: "When is surgical preparation of the mouth indicated and how much surgical interference will improve a given case?" Of course, the value of using roentgenograms as a routine procedure in oral surgical work cannot be overemphasized. In all exodontia cases, if the presence of broken roots is suspected, roentgenograms should be used to check up these conditions. We must disregard these cases as typical of the condition under consideration for alveolectomy. The cases that call for surgical mouth preparation are those that do not meet the requirements of a perfect mouth. According to Dr. Pike, the ideal mouth presents the following conditions: The jaw ridges should be in a normal relation to each other, and the individual ridges should have regular occlusal planes, free from variation in height. The ridges should be smoothly rounded, with no undercuts present and no sharp spicules or ridges; and the muscle attachments should be in their usual positions. Unless the practitioner can retain this mental picture of the ideal or normal mouth, he is unlikely to arrive at a correct decision as to when to resort to surgical improvement of the presenting deficiencies. That is essentially what we mean by alveolectomy: surgical mouth adjustments for the proper retention of artificial dentures. Deviation from the ideal condition might lead one to justify surgical intervention. I feel that conservatism should be our attitude and we should guide ourselves by the normal rather than the ideal. By that I mean that the condition, as it is found in a given mouth, should be estimated in terms of possible abnormalities and mutilation. I find that malformations, for our present purposes, may be classified in three groups; 1. Abnormalities and mutilation of the alveolar process and of the palate. 2. Hypertrophied tissue and flabby tissue. 3. Abnormal labial frenums and other muscle attachments. When these conditions prevail, the practitioner may use his judgment as to whether he needs to institute alveolectomy or the surgical removal of a part or parts of the alveolar process or bone excrescences from the palate to secure proper service from artificial dentures. Dr. Pike calls attention to the conditions that I have considered under this classification. May I call your attention to the large variety of jaw malformations, especially of the maxillae which, for our purposes, are grouped under hereditary or congenital and acquired. We find, for instance, massive undercut maxillary tuberosities which have no significance while the teeth are present, but offer complicated problems when the teeth are removed and restoration with dentures is desired. Dr. Pike speaks of two procedures of surgical mouth preparation. One refers to the case which calls for the removal of the teeth at the time of operation. The other refers to the edentulous mouth. In describing the technic for the first procedure, the major points are

1. Winter, Leo: Internat. J. Orthodon., 17:581 (June) 1931.

brought to our attention, and I need not elaborate on these as they are sufficiently clear. I wish to emphasize another factor that should not be overlooked, especially by the beginner. The operator should make sure not to remove any more osseous structure than is absolutely essential. It is advisable, therefore, to replace the flaps from time to time to observe progress. There is another point to be considered, and that is that one must guard against overlapping of the lips of the incision. This point should be emphasized because unless sufficient tissue is cut away on either side of the incision, to expedite healing, a ridge of flabby mucous membrane will form, which is highly undesirable as its presence will defeat the purpose of the operation. Before closing, I wish to stress two considerations brought out in the paper which are most important if this type of surgical work is to develop. We must recognize this procedure as as serious and important as any other surgical work in the mouth. We must observe the requirements of asepsis, anesthesia and a correct technic with a minimum of trauma. Another essential to success in alveolar surgical work is the avoidance of postoperative complications. Dr. Pike has mentioned the need of instructing the patient to anticipate some discomfort. Home care is essential. We have found as a valuable adjunct in the control of swellings, in addition to the ice, the use of mallophene, which helps in maintaining the tone of the wounded tissue. It is prepared by placing 1 part of powdered mallophene to 2 parts of distilled water in a test tube and heating it over a bunsen burner until the powder is completely dissolved. It should then be permitted to cook slightly and should be applied with a sterile cotton applicator. With this care, there should be little worry over the outcome.

Harry J. Horner, Pittsburgh, Pa.: Why a prosthodontist should be asked to discuss a paper written by an exodontist, I do not understand, unless with the hope of drawing the two specialties a little closer together. If we could have a closer understanding of each other's problems, the end-result would be a better service to our patients. All papers on this subject should have a paragraph or two dealing with the subject of preextraction records. As far as I am able to learn, every community has some exodontists who seem to have no knowledge of the great importance of these records. Special surgical preparation of mouths for artificial dentures is made with the idea of giving the patients satisfactory dentures, but the patient will not be satisfied if the dentures do not look well; hence, the importance of preextraction records. I agree with Dr. Pike when he advocates roentgenographic examination of all edentulous mouths. Much trouble can be prevented for both the dentist and his patient if this procedure is followed. Of the two general plans submitted by Dr. Pike, I would accept the first. Results that are satisfactory in most cases can be obtained by making whatever surgical correction is needed at the time of extraction. Many men make a cast of the mouth and study it before any extracting is done. In this way, it is possible to see what it is necessary to do. I cannot accept the second procedure suggested by Dr. Pike as being better than the first. We should be more willing to place ourselves in the patient's place and then do nothing for the patient that we would not want done to us. I would not want to go through two operations when practically the same result could be obtained by one operation. From the economic standpoint, it is a question whether one is justified in deceiving the patient, as it is likely to become common knowledge that Dr. Blank frequently finds it necessary to perform a second operation. It would be rather awkward to tell a patient who wishes to pay cash of the need for the second operation and collect a second fee.

ESSENTIAL FACTORS IN FIXED BRIDGEWORK*

By STANLEY D. TYLMAN, A.B., D.D.S., M.S., F.A.C.D., Chicago, Ill.

IN considering the factors in fixed bridge construction, one is immediately impressed with the fact that there are two general phases to be considered. The first may be designated as the clinical or biologic, the second, the technical or mechanical. The time is not long past when a majority of the profession overemphasized the latter to the disadvantage of the former. The past few years have swung the pendulum back toward the golden mean wherein biology and mechanics are assuming their relative importance in the scheme of restorative dentistry.

While much has been said and written with reference to the histology and the reactions of normal tooth structure and its investing tissues, many facts remain to be ascertained. The application of any newly acquired knowledge to clinical practice is proving its value daily. Although it is true that such scientific knowledge is the groundwork of clinical practice, it is also true that clinical experience precedes research or scientific investigation. The problem is evolved at the chair; its solution sought through the microscope, and, when attained, it means only one item solved in the large problem of vital reactions; which helps to explain a few clinical experiences and enables us to make clinical progress.

*Read before the Section on Partial Denture Prosthesis at the Seventy-Fourth Annual Session of the American Dental Association, Buffalo, N. Y., Sept. 14, 1932.

Some years ago, we undertook to keep accurate records of all restorations that were made in the mouths of patients. The data recorded include roentgenographic, clinical and dynamic tabulations. We have endeavored, where possible, to study tissue reaction to unnatural or undue stresses as compared to the reactions of similar tissues in the same mouths under natural and normal stresses. That such a study involves unlimited ramifications is evident. For the present, let us consider briefly a certain few tissues.

The term "normal" has great latitude; it is not subject to personal dogmatism. It pertains or "conforms to a more or less permanent standard, from which, if the individual phenomena deviate on either side, such deviations are to be regarded as self-corrective."

There is great danger, in the enthusiasm of research, of confusing accidentals with essentials as far as they relate to clinical procedures. The pulpless tooth problem is an excellent example. If the broader idea of normal is kept before us as we try to establish a sane relation between microscopic and clinical findings, there is less likelihood of arriving at questionable conclusions.

Although there is a wide variety in the arrangement of tooth structure and its adjacent tissues, it is well to establish a more or less permanent standard whereby deviating phenomena may be recognized. Earlier investigators have given us a clear picture of the structure

and functions of the cementum with its lamellae, lacunae, cement corpuscles and embedded fibers of the peridental membrane serving as a means of attachment for the tooth; also the peridental membrane with its connective tissue fibers, its fibroblasts, cementoblasts, osteoblasts and osteoclasts, its blood vessels, nerves, lymphatics and glands; exercising its function of tooth retention, bone or cementum formation and absorption, and that of sensation, and, lastly, the alveolar process with its bone cells, lacunae and canals, serving as a means of attachment to the jaw bone proper and offering resistance to the applied forces.

We find that the cementum covers the root; that it is subject to processes of absorption and rebuilding and that the former is as physiologic as is the absorption of roots of deciduous teeth. Cementum has been pictured to us as being a tissue undergoing a constant change of form not through any initiative of its own but through its formative elements, the cementoblasts. To this extent, it is not physiologically active, but rather it is the result of physiologic activity. The peridental membrane has been described not only in its protective and retentive capacities but also in those of a shock absorber. Subjected to stresses within reasonable limits, this tissue reacts normally. The alveolar process depicts the economy of Nature in that the bone is laid down in such a manner that the greatest amount of support is obtained with a minimum of bulk. With this condensed composite in mind, let us consider the tissues in their reactions to certain forces and stresses.

In general, "when one body acts upon another in such a way as to change either its motion or its size or shape, the one body is said to exert a *force* upon the other." Such is the law of physics. "A *stress* is an equilibrating application of force to a body," and the "*equilibrium* of a body is called stable if on being slightly displaced it tends to return to its original position" or state. Undue stress may be caused by tension or compression or a combination of these. Having defined these terms, let us consider their biologic applications.

It is evident that the difference between a physiologic reaction and a pathologic one lies not so much in the nature of the force as in the degree of the irritation, be it mechanical, bacterial or chemical, and, secondly, in the ability of the tissues to respond favorably or otherwise to their new environment. If a force is normal, it acts as a stimulant; if it is abnormal, it results in either an acute or a chronic irritation, contingent on its being temporary or sustained.

Under normal conditions, the application of proper force is not to be avoided; in fact, it is essential to the well-being of the tissues. Nature has so arranged the investing tissues that, with each closure of the mouth, each act of deglutition and during the process of mastication, the teeth are constantly subjected to intermittent pressure which is stimulating in its effect. It induces an increase in circulation, it prevents a tendency toward stasis. The force exerted during acts of involuntary closure varies from 5 to 8 pounds each time. If we consider that we perform this act unawares over a thousand times a day, we may appreciate more fully the cumulative stimulation exerted. In addition to this, the teeth are brought in contact from 3,000 to 5,000 times during the course of a meal. It is stated that the average force exerted in a normal mouth is 1·75 pounds.

In our tabulations of the poundage which individuals are able to exert, we

found that the average is not so high as that cited by G. V. Black. The difference is explained by the fact that whereas his records were obtained on patients with normal, natural dentures, ours were taken from patients who were in need of restorative work and who consequently possessed an impaired dental apparatus. Our average was one-third that reported by Black.

This fact is significant in that it evinces a retrogressive change in that the tissues are less able to resist force. Conversely, after the dental apparatus had been restored as nearly to normal as it was mechanically and therapeutically possible, we have noted, in most instances, a marked increase in the ability of patients to exert force. This corroborates Noyes' statement that "tissues are formed in response to mechanical stimuli and conditions, and therefore the arrangement of tissues must be considered, not as having been designed to sustain the forces, but as being the result of forces to be sustained, and therefore beautifully adapted to them."

Where excessive forces are not applied suddenly but gradually, we find that Nature readily compensates for this change. Such a gradual increase in force does two things: it compresses the peridental membrane in one area and stretches and pulls the fibers in another. Absorption takes place to relieve the pressure and bone or cementum formation reinforces the pulled fibers. In each case, it is noticeable that the fibers have been shortened. Should any absorption take place in the alveolar process owing to the pressure, we find that the cancellous bone outside and adjacent to the cribriform plate is also undergoing changes. After the adjustment has taken place, new cancellous spicules are built and arranged to meet and counteract the new forces.

Our observations lead us to believe that the peridental membrane becomes thinner as one gets older and in proportion to the severe use to which the teeth have been subjected. In the thinner membrane, blood vessels usually are protected in part against the danger of excessive stress by being partially embedded in recessed grooves in the alveolar walls. Because of limited movement, there is also less danger of injury to the thin membrane. In several thousand cases under clinical and roentgenographic observation, we have found that, almost without exception, where the poundage exerted by the patient increases, the thickness of the membrane decreases. There is also a concurrent increase in the thickness of the cementum and the cribriform plates of the alveolar process.

Today, it is the exception rather than the rule for the well-meaning dentist to consider a partially edentulous mouth other than an impaired organ of the human body. The vital question is not so much the number of cavities present or the edentulous areas to be restored with bridges as it is the degree of endeavor on his part to analyze and diagnose existing conditions and to determine the means best suited to restore the impaired or lost functions of that organ. This cannot be done if the mouth is isolated; rather must it be considered an integral part of the human body. It is essential, therefore, that a complete case history be obtained, together with full-mouth roentgenograms and mounted full casts. There are times when, from a physical and a mechanical standpoint, a fixed bridge could be employed, yet, owing to the presence of some general systemic disturbance, its use is contraindicated. To

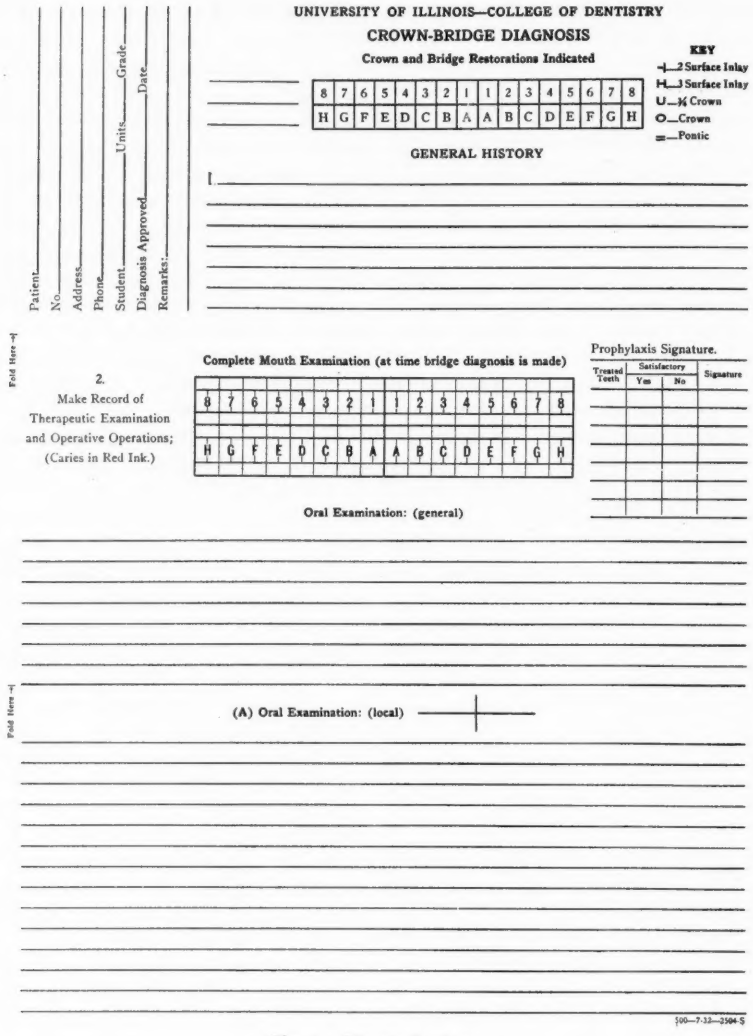

Fig. 1.—Diagnosis sheet.

assist in correlating the biologic with the mechanical factors, we have prepared and suggest the use of diagnostic sheets. (Figs. 1-2.) By these or similar means, one is enabled to obtain a thorough general and local examination in proper sequence. Full casts and roentgenograms are indispensable in this procedure, and need no defense. The relative length of root and crown, the amount

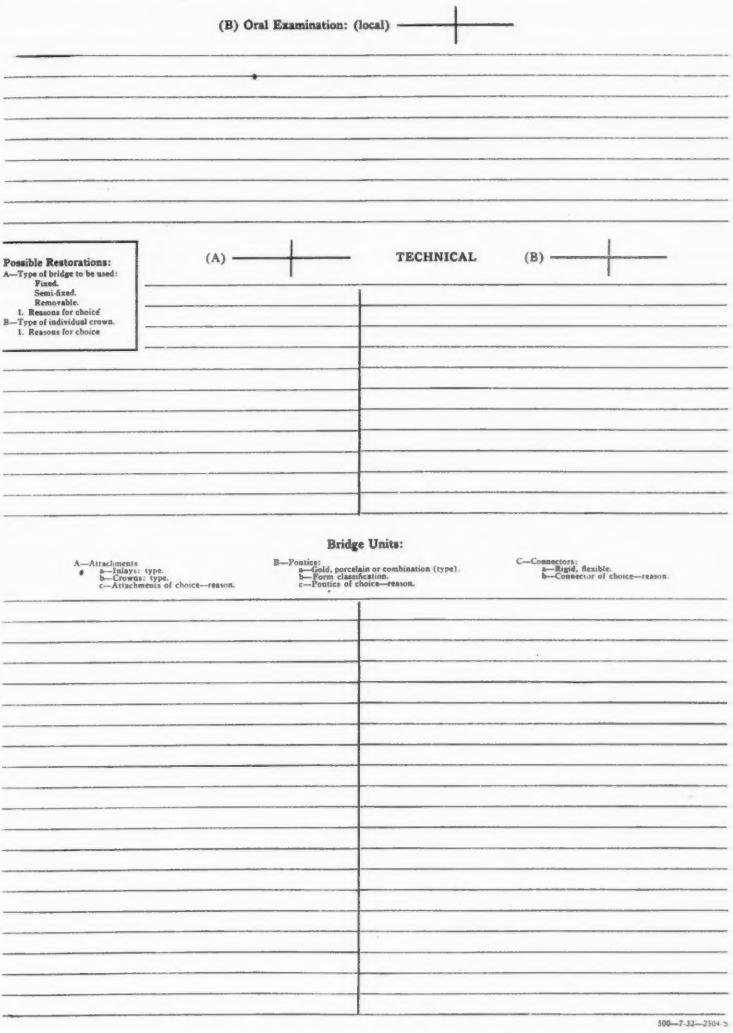

Fig. 2.—Reverse side of diagnosis sheet.

of peridental membrane attachment to the root and bone, the condition of the surrounding bone, the degree of calcification of the lamina dura and its supporting trabeculae, and the position and condition of the pulp, these are but a few of the things that the roentgenograms may reveal. Not only are full study casts valuable from the standpoint of a permanent record, but also, quite fre-

quently, where an edentulous space is of long duration, we find that the opposing teeth have gravitated or risen in their sockets to such a degree that this condition, unless rectified, prevents the construction of a bridge conforming to the accepted laws of occlusion. It is very easy to overlook or to minimize the condition in the mouth; whereas, on study casts, the condition and degree of lengthening are apparent at once.

How often has not an inclined abutment been used to carry an attachment which, after the bridge was completed, lacked the proper relation with the opposing teeth? It is difficult at times to appreciate the full degree of inclination by direct observation in the mouth. This may explain why so many teeth inclined beyond the angle of safety are used as abutments. Especially is this true in the lower arch. Leverage so produced will inevitably destroy the usefulness of the bridge. Such teeth, if possible, should be brought into proper relation by orthodontic procedures. Study casts assist in arriving at a decision.

There is one other factor that I should like to discuss before entering on the mechanical phase of the subject. It is our custom, after a mouth has been rehabilitated, to examine by roentgenograms all restorations in the patient's mouth, and to check these against the clinical findings. For purposes of record and future follow-up, we employ a crown-bridge history file. (Fig. 2.) In this envelope are placed the roentgenograms taken prior to the construction of the bridge as also are those taken subsequently to its placement. The complete data having been recorded on the outside of the envelope as indicated, it is then filed until such time as the patient is recalled for a periodic examination, which takes place six months later, when new roentgenograms are taken and another clinical examination is made.

Crown - Bridge History

Name — Patient No. — File No.

Address — Age — Date Completed

Tooth	Examined	Pulp	Condition of Paradontal Tissues			Bite	Abrasion	Re-grind	Prepared			Occlusion			Health	Therapeu-
Crown	Date		Gingival	Osseous	P. M.	L L B S		M . M.								
Bridge			1. Buccal 2. Lingual 3. Proximal	1. Gingival 2. Middle 3. Periapical	1. Gingival 2. Middle 3. Periapical											
Fixed Semi-Fixed Removable		Vital Non-Vital	Normal Recession Inflamed	Normal Aber'tn Calcif'n	Normal Thicken'd Pathologic Improving	Restored Side Opposite Side	Uniform Lab. Occl. Ling. Occl.	Attachments Pontic	Hot Water Infiltration Block Dry	Cleanliness Susceptibility	Normal Distal Mesial	Poor Fair Good				

Fig. 3.—Crown-bridge history envelope.

Such a procedure affords an opportunity for comparative studies of the most recent and the previous roentgenograms with reference to any changes that may have occurred during the interim.

As may be noted from the file, the data recorded are quite in detail. A record is kept of the type of bridge placed and the condition of the pulps of the abutment teeth, and the periodontal tissues are tabulated with respect to the bone, membrane and gingivae.

In addition, we record the poundage which a patient is capable of exerting with the restored teeth as compared to the corresponding natural teeth on the opposite side of the arch. As previously mentioned, the average normal force exerted is approximately 175 pounds. It may be of interest that, in a partially edentulous mouth, one with impaired function, the average force for women is 40 pounds, while for men it is 56. In view of such evidence of functional impairment, it is encouraging to observe that, in the course of a few years, the average poundage of these patients increases noticeably. It is rare to find that the restored mouth recuperates sufficiently to attain what might be considered the normal average poundage.

This incomplete regeneration is not due to mechanical deficiencies but rather to a permanent injury which the supporting tissues sustained. When we undertake to treat and restore an edentulous or a partially edentulous mouth, we are in a position to restore the subnormal tone of the periodontal tissues to normality only within the limits of the injury sustained. We cannot add to the tissues: we merely salvage and restore what is left. Detached fibers may not be reattached, but we are in a position to remove the cause and prevent further harm to the peridental membrane.

Our study further indicates that there is an average gain of 81 per cent from plus susceptibility to minus and an 18 per cent improvement from poor to good health after proper restorative service. Important but minimized factors are the relative percentages and ages of men and women patients needing bridges. An analysis discloses that women outnumber the men two to one, although their maximum requirement age-periods differ. For women, it is between the ages of 30 and 40, while for men it is from 20 to 30. The accompanying table is significant.

PERCENTAGE AND AGES OF THOSE REQUIRING BRIDGEWORK

Percentage	Ages
Men	
10	17 to 19
50	20 to 29
25	30 to 39
10	40 to 49
5	50 to 55
Women	
5	17 to 19
33	20 to 29
47	30 to 39
13	40 to 49
5	50 and over

We hesitate to surmise that these percentages are the result of economic exigencies. Rather, we believe that they connote a biologic problem. Further research in this direction should prove enlightening.

Our crown-bridge history also indicates the method employed during the preparation of an abutment; that is, as to whether an anesthetic is used. In a résumé extending over many years, it is found that, in the hands of students at least, those teeth prepared while anesthetized show a higher mortality rate than those prepared under a stream of warm water without an anesthetic. By removing the danger signals which a pa-

tient exhibits on too close or too rapid cutting of tooth structure, the possibility arises of endangering the vitality or at least the normality of the pulp. Generally, we do not employ anesthetics except in unusual circumstances.

The last column of the chart is devoted to the so-called "therapeutic" record, involving the case history and file number of the treatment and filling of the root canal. There are many who exclude treated teeth and confine abutments to teeth with vital pulps only. Such an extreme position is regrettable, for we find that, although 85 per cent of all abutments used by us have vital pulps, the remaining 15 per cent are treated teeth. Semiannual check-up reveals that only 3 per cent of the latter failed to respond to the increased requirements of bridge restorations. Does not such a percentage justify a continuance of a tolerant attitude toward the use of a properly treated and filled root as an abutment? On the other hand, who may positively state that because bridges are placed only on abutments with vital pulps, all danger of pathologic sequelae has been eliminated?

Having properly designated all the factors in the case, the envelope is numbered and classified as follows: fixed bridges, semifixed or removable. Individual crowns are classified as those with vital pulps or those treated. We have at the present time at the University of Illinois several thousand such case histories, together with their corresponding study casts and diagnosis charts. This mass of material enables us to arrive at an understanding of the possibilities and limitations of bridgework, and it also affords us a rational basis to confirm theories or to question untried hypotheses. If all school clinics and dentists kept similar records, such data in a few years would prove priceless. We have, for instance, been able to determine the percentages of inlays used as attachments as compared to three-quarter and full crown castings; also, their incidence with respect to tooth and arch location. From a pedagogic standpoint, this has proved quite important.

We were enabled to determine the number of treated teeth used as abutments. Likewise, in a study of more than 1,000 unselected, consecutive bridges, the aggregate number of units involved was in excess of 3,300, or an average of approximately three units per bridge. Of this number, there were over 2,100 abutments and 1,200 pontics. We find, on comparative study, that the two sides of the mouth are equally susceptible to caries and loss of teeth. In distinguishing between the upper and the lower jaws, we find the difference more marked. In the upper, we have 1,200 abutments; while, in the lower, there are 966. A further analysis reveals that, in the upper arch, the cuspid is used the greatest number of times, while the lateral is used the least, with the exception of the third molar. The remaining teeth assume the following numerical importance: the second bicuspid, second molar, first bicuspid, first molar and central incisor. In the lower arch, results differ somewhat. The second molar is employed the greatest number of times as an abutment, while the lateral and central incisors are used the least. The remaining teeth assume the following numerical relation to the second molar: second bicuspid, first bicuspid, third molar, first molar and cuspid. We conclude from these tabulations that the upper first bicuspids and first molars are the teeth most frequently replaced; while, in the lower arch, the first molar has the highest mortality rate.

Having considered the clinical or bio-

logic aspect, let us review briefly the technical or mechanical factors. It is understood that a prerequisite for any type of bridgework is the elimination of all pathologic conditions and favorable general health. Locally, the abutment teeth should meet certain physical requirements. It is not safe to use as an abutment a tooth that does not possess a root sufficiently long and with sufficient peridental membrane attached to withstand the forces to which it might be subjected. There should be at least one half of the original length attached.

Another factor to be considered is the relative number of abutments and pontics. Although the data previously given show that the average bridge consists of three units, that is, one pontic and two abutments, we have found that conditions arise where a four-tooth or even a six-tooth bridge may be employed safely and with no danger to the general health of the patient. A cuspid to molar bridge is frequently indicated and placed; also, a cuspid to cuspid employing only two abutment teeth, provided both are physically and biologically acceptable. Do not misunderstand me: the latter types are the exceptions. The ideal fixed bridge is one pontic supported by two abutment teeth.

Attention is next drawn to the structural elements of the bridge; namely, the attachments and pontics and the means of uniting the two. As any one of these items could deservedly command attention for a lengthy dicsussion, I shall touch only the high spots. The ideal attachment should possess qualities of retention, prevention, tooth form and esthetics. Not only must these positive attributes be present, but it is just as essential that nothing be done to impair the future integrity of the tooth. This is particularly true when the factor of prevention is involved. Prevention, which is sometimes confused with deep and promiscuous cutting of tooth structure, should mean extension of outline into cleansable or immune areas. It should mean the cutting of the minimum amount of tooth structure consistent with sufficient mechanical retention. It should mean every effort expended to protect and conserve the normality and vitality of the pulp and the surrounding tissues. The retentive factor has already been stated.

The restorative requisites of an attachment are generally understood, but frequently disregarded. Generally speaking, the occlusal surfaces conform to the requirements, but the danger lies in the reproduction of the axial surfaces and the gingival area.

The factor of esthetics, though important in the anterior region, assumes a minor rôle in the posterior. Two of the greatest offenders have been the incisal and proximal display of metal. These may be controlled and, to a great extent, eliminated by judicious outline and finish of castings.

In our work, we have found that the two-surface inlay has a very limited use as an attachment. We limit it to those teeth serving as supports to lugs or rests in the semifixed types of bridges. The typical mesioclusodistal attachment may be used with satisfaction provided the crown portion of the tooth is sufficiently long and strong enough to withstand the forces to which it might be subjected. It is indicated in a simple three-unit bridge, but should be used with caution when two pontics are involved. The third and most universal type of attachment at our disposal is the three-quarter preparation. Its virtue lies in the fact that a maximum of retention may be obtained with the least danger to the normality of the pulp and with a minimum sacrifice of tooth structure. The three-quarter is indi-

cated where the number of missing teeth exceeds two, and sometimes in the case of two missing teeth where the bite is exceptionally strong. We favor the preparation with a gingival bevel and no incisal groove. Failure of this attachment is the result of too great a convergence of the axial grooves together with the use of improper alloys or the misuse of proper alloys.

The full gold crown, when not objectionable from an esthetic standpoint, is a safe and efficient attachment provided the tooth is properly prepared to receive it. The gingival tissues in contact with properly fitted crowns show the same state of health as exists adjacent to the gingival margin of well-finished inlays.

Although all-porcelain or all-gold pontics may be employed, we are concerned mainly with the type employing gold for the occlusal aspects and porcelain at the gingival and labial aspects. The prime consideration in a pontic is proper form. A pontic rarely attains the dimensions of the lost tooth. In fact, it is recommended that it be made smaller, particularly through the buccolingual dimension between the cusps. To further reduce the strain, we narrow the pontic in its lingual half. This widens the embrasures and, at the same time, reduces the occlusal area. Natural grooves are accentuated and supplementary ones created through the marginal ridges.

From the contact points, the pontic tapers until the porcelain contacts the gum tissue. Of all the materials at our disposal, it has been shown that highly glazed porcelain is most compatible with the investing tissues. When a pontic is properly shaped, glazed and brought in contact with the ridge without pressure, it is observed that the tissues respond to the extent that they fit themselves snugly around the periphery of the pontic. We are limiting the root extension type of pontic to the anterior teeth and we use it then only under certain conditions, preferring to let the sockets heal after extractions and then use the rounded tip or the modified saddle.

The tip or egg shaped type of pontic may be universally used in the lower arch. In the upper denture, because of esthetic requirements, we are frequently forced to use the saddle type. This term is a misnomer. It is slightly concave buccolingually, but mesiodistally it is convex. Care should be exercised not to have food impaction at the gingival margin.

Although with a stressbreaker there is less liable to be a transfer of foreign stresses to the supporting teeth, the outstanding benefit lies in the fact that the bridge may be set in two parts, the first being finished before the second is inserted. The other advantage in its use is seen when one of the abutments is malposed. A stressbreaker should never be used when that part of the bridge extending distally from the stressbreaker occludes with a tissue-borne appliance. The resultant gravitation may cause dislodgement of the lug. Generally, stressbreakers are contraindicated in four-tooth bridges. If conditions demand, we should not hesitate to employ a completely fixed bridge, as the resultant slight inhibition of individual tooth movement will be readily compensated for by Nature, if we have observed all other requirements.

DISCUSSION

DeForest Davis, Cleveland, Ohio: Our objective in all dental operations is the establishment of health, and while an understanding of the mechanical procedures involved is necessary, it is also equally necessary that we have a broad basis in a knowledge of the biologic aspects of dentistry. Dr. Tylman mentions the golden mean wherein biology and mechanics are assuming their relative

importance in the scheme of restorative dentistry. This is important because our only hope of attaining a solution of the problem of the etiology of tooth decay, as well as many other problems, is through an understanding of the biologic factor in our work. The system of records and tabulations described by Dr. Tylman is something that should be used in every dental clinic and by individual dentists wherever possible, as the data thus accumulated are essential to a scientific study of our problems. I would like to direct attention to Dr. Tylman's discussion of the forces of occlusion. I assume that he means occlusion, although he does not use the word, because these stresses are by far the most important ones in the restoration of dental function. He mentions the pressure applied during mastication and the act of deglutition as well as closure of the teeth. The proper distribution of these stresses of occlusion is the most important single factor in fixed bridgework or any restoration which deals with the occlusion, because, while a restoration or bridge may conform to every other requisite, if the occlusion is unfavorable we cannot expect a full measure of success. In fact, ultimate failure is almost certain. The importance of this point becomes apparent when we analyze the causes of the failures which appear in dental practice. I should like to ask Dr. Tylman if he has made records of failures in bridgework and what his findings have been. It seems to me that little real progress can be made unless we are thoroughly familiar with our failures and the causes for them. The statement that 85 per cent of abutments used have vital pulps indicates a definite trend away from devitalization, which I believe is necessary if we are to fully protect the health of our patients. Dr. Tylman says that, "Semiannual check-ups reveal that only 3 per cent of the nonvital abutments used fail to respond to the increased requirements of bridge restorations." I should like to have him tell us what these requirements are and what tests were used to determine that the nonvital abutments mentioned had met these requirements satisfactorily. Our attention is directed to the importance of a thorough preliminary examination before definite plans for restoration are made, this to include roentgenograms and plaster casts, as well as ocular observation and tests in the mouth to determine the condition of the teeth and tissues. The imporance of this diagnostic examination cannot be overstated. It forms the foundation of all restorative work. It is well known that thorough diagnostic study is the foundation of clinical success, and, by the same token, faulty diagnostic study forms the foundation of clinical failure. The members of this section undoubtedly recognize the value of biology as it applies to our problems in fixed bridgework. Nevertheless, we all feel the futility of attempting this work without a thorough knowledge of the technical or mechanical aspects involved. For this reason, I regret that Dr. Tylman, in his discussion of the mechanics of fixed bridgework, particularly with reference to the various types of abutments and pontics used, did not point out in greater detail, with illustrations, perhaps, the features which, from his experience and observation, it is important for the dentist at the chair to understand. I recognize that in papers before this body the essayist is always handicapped on account of lack of time; it is therefore, impossible to give these subjects the thorough discussion which their importance merits. I cannot help but feel that Dr. Tylman was conscious of this handicap. He has tried to cover a broad subject in much less time than he should have had, and has done so exceedingly well.

A STUDY IN PARTIAL DENTURE CONSTRUCTION*

By THE PASADENA PROSTHETIC STUDY CLUB

THE PARTIAL DENTURE PROBLEM

WHAT methods of partial denture construction do we use? Why did we discard previous methods? Do we know why one technic is better than another? To our minds, is one method the answer to all our problems in this field? Do we have a definite method of classification of our partial denture cases and a remedy for each, as the orthodontist has?

Those of you who have made a study of dental literature and the progress which dentistry has made know that advancement has come, not by discarding everything for some man's new idea, but by improving the already established and proven methods. We have in our profession men with inventive or creative minds, and it is to these men that we owe much. That one man has a newer idea does not mean that all that preceded his idea should go into the discard. We should keep our minds flexible and analytic, forming the habit of weeding out the good from the less valuable methods. We have had a chart made which is probably familiar to all of you who know of the studies which have been done along this line at the University of Toronto.

Thus, we see that the partial denture problem is a bio-engineering problem, or an engineering problem which must be modified by the biologic factors involved in each individual case. This is why the problem of designing our partial dentures should never be given to the laboratories. The dentist should be the architect, and it is his duty to understand thoroughly all the biologic and engineering problems involved in the care of each mouth. These should be studied first on charts and then indicated on the models, before the case is sent to be constructed. The laboratories are glad to give the dentists a designing service, and many dentists are glad to be relieved of the mental strain required to study and do their designing properly; but who can or should be better qualified to do this part of the work than the man who has seen and studied the actual mouth conditions? To leave this to the laboratory is to ignore completely the biologic factor. If we should do nothing more than to create a determination within each man to study and design his own cases and, if necessary, obtain consultation on them, but send his models to the laboratory with definite, studied designs and specifications, we would feel that our time had been well spent. If more men would do their own work of construction or have it done by trained technicians in their own laboratories and under their constant supervision, we should see an improvement in prosthetic dentistry. A laboratory cannot turn out work in quantity production, and for twenty-five

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or fifty men, and give each case the individual attention that particular men require.

It is a disgrace to our profession that so many graduated from thinking when they finished college instead of commencing to think. If you do not think that this is true, spend a little time in a commercial laboratory and see what is received from the dentists' offices and what is expected. It is no wonder that the laboratories feel the necessity of offering a designing service.

Before advancement in any study is made, a classification or grouping of like cases is necessitated. This gives a common language for discussion, and it also

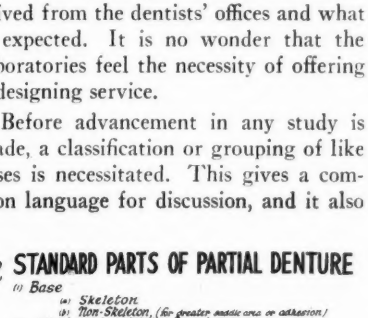
The STANDARD PARTS OF PARTIAL DENTURE
(1) Base
(a) Skeleton
(b) Non-Skeleton, (for greater muscle area or adhesion)
(2) Attachment (joining teeth to base)
(3) Teeth, artificial
(4) Retainers (a) Direct
(i) Precision (interlocking devices)
(ii) Non-Precision
(a) Adhesion
(b) Clasps (i-3 arm) Mesio Distal, Bucco-Lingual
(c) Crib (single or multiple) or Line Angle
(d) Interlocking devices
(b) Indirect
(5) Connectors
(a) Rigid
(b) Semi-rigid
(c) Flexible
Called stress-breakers
(6) Occlusal Rests, (directing loads of mastication along the long axis of the natural teeth)

Fig. 1.—Outline of standard parts of partial denture.

makes it possible to simplify a study of any subject. The charts which we have here present a complete classification of all partial denture cases into four classes. Then, there are four modifications of each class with the exception of Class IV, which admits of no modification. The classification is made with regard to the location and number of edentulous spaces in either arch and is the one now being taught in the colleges. There are more than 65,000 possible combinations which have been worked out mathematically, but all of these can be grouped into these classifications and studied accordingly, while it would be impossible to make a scientific study of such a large number.

Often, there are several designs that will work equally well, but there are definite principles which must govern scientific designing. Often, the reason or the thought back of the design is not seen at first glance. On these casts which are shown here, we are, of necessity, presuming certain conditions. These were all worked out on the assumption that the abutment teeth were all sound and firm and that the ridges were well healed,

A COMPARISON OF THE PROBLEMS OF ENGINEERING AND THOSE OF PARTIAL DENTURE CONSTRUCTION
1. PRELIMINARY
ARCHITECTURE.—An addition to a Group of Buildings
(a) Preliminary survey of site, foundation available and adjacent buildings, and the collection and study of all facts which bear upon the requirements of the future addition, including general type of architecture.
(b) Choice of general type of building to harmonize with the present building.
PROSTHETIC DENTISTRY.—A case in Partial Denture service
(a) Examination (general by a physician if necessary) and oral by the dentist, and study of all facts bearing upon the requirements of the future restoration.
(b) Diagnosis and the cure of desease, also any other preliminary work.
(c) Choice of appliance full Portal or Crown Bridge restoration.
2. DESIGN.
(a) Complete set of blueprints of the proposed addition and the foundation, and occasionally a model of the proposed building.
(b) Written or printed specifications as to labor and materials.
(a) A mental picture, or an actual drawing of the proposed restoration, and its foundation, often preceded by study casts.
(b) Verbal or written specifications, if the co-operation of laboratory assistants is required.
3. CONSTRUCTION.
(a) Preliminary work on standing buildings.
(b) Excavation, foundation, erection, decoration and finishing of the addition.
(a) Preliminary work on remaining teeth if necessary.
(b) Impressions, casts, bases, articulation of teeth (function and esthetics), further construction, finishing.
4. INSTALLATION.
(a) Work involved in making the building ready for occupancy.
(a) Insertion of denture, and further work as required (as rapid grinding, lapping and rebasing), until the denture is finished.
5. MAINTENANCE AND REPAIR
(a) As required in the building.
(a) As required in keeping the appliance in good condition and adjacent tissues healthy.

Fig. 2.—Comparison in outline of problems of engineering and those of partial denture construction.

that all absorption due to the changes following extraction had taken place and that the ridge was firm and had been subjected to stresses previously by another restoration.

ROENTGENOGRAMS

In partial denture construction, as in all other branches of dentistry, it is im-

possible to make an intelligent diagnosis and prognosis without the aid of properly exposed and developed roentgenograms.

Of what benefit is the most beautifully constructed partial denture from the standpoint of esthetics and mechanics if the foundation upon which it is built is faulty? How many times have we, in our practices, observed just such a restoration as this, a total failure because the prosthodontist has not taken sufficient care in ascertaining the condition of the remaining natural teeth and the general health of the patient?

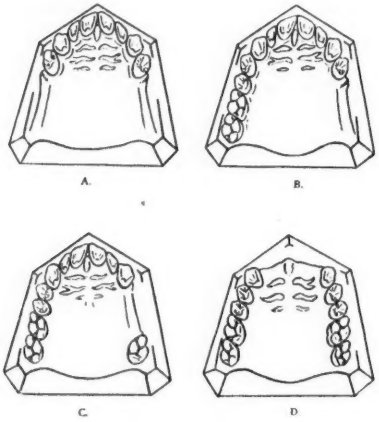

Fig. 3.—Classification of partial dentures according to Edward Kennedy. *A*, Class I, bilateral distal extension. *B*, Class II, unilateral distal extension. *C*, Class III, abutting tooth distad from space. *D*, Class IV, no abutting teeth anterior to space. Class IV has no modifications.

Properly interpreted roentgenograms, with a visual digital and study model survey, give us a complete picture of oral conditions that can be obtained in no other manner. By means of roentgenograms, we are able to ascertain: 1. The density of the alveolar process, both the cortical layer and the underlying trabeculae. In the mandibular arch, the cortical layer appears much more distinctly than in the maxillary arch. Also, the trabeculae are denser, and it is well that this is the case, since the area to be covered on the mandibular arch is far less than that on the maxillary. 2. The length of the roots of teeth imbedded in the alveolar process and the relation of that portion to the total length of the tooth. 3. The diameter of the roots of the teeth. 4. The presence of broken roots. 5. The presence of root fragments, foreign bodies and unerupted teeth. 6. The presence of areas of residual infection.

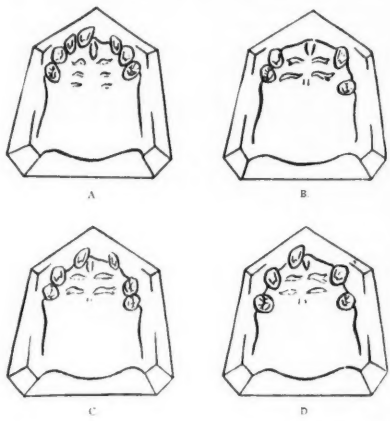

Fig. 4.—Class I cases: *A* to *D*, modifications 1-4, respectively.

7. Alveolar resorption around the remaining natural teeth. In order to recognize the abnormal, we must first be able to recognize the normal. Howard H. Jackson, in Nicholl's "Prosthetic Dentistry," points out that the crests of the septums are not all spear-shaped. Should the teeth be square or straight-sided, we have the typical spear-shaped crest with the cortical layer well defined, regardless of the position of the teeth in the arch. If the teeth are bell crowned or slightly separated, this is not the case. The crests

of the ridge are flattened and the cortical layer is not so clearly defined. 8. The presence of apical abscesses. 9. The presence of cysts. 10. Thickening of peridental membrane due to traumatic occlusion. 11. The presence of decay under fillings, inlays, etc., present in the teeth. 12. The presence of decay on the proximal surfaces of teeth.

In cases of doubtful teeth, we should check our findings by means of a vitality test. Sometimes, transillumination gives us information not otherwise obtained.

Should it seem desirable to retain any doubtful teeth, a competent internist should be consulted, and his opinion as to the systemic condition of the patient should be our guide.

By observing the type of recession, if any, and the density of the cortical layer and the cancellous structures, we are able to give a prognosis of the case with some degree of intelligence. Uniform recession of the crests of the septums is the most favorable type. As a rule, this type of recession is, or has been, associated with heavy deposits of calculus. Pocket formation around individual teeth is less favorable. If the pockets can be eradicated, the teeth may be retained; otherwise not.

The infiltrative type of recession is the most troublesome of all. Fortunately, it is less frequently met with than any other type. Clinically, there is a progressive recession of the soft tissues, associated with considerable discomfort of the natural teeth, and very little demonstrable pus formation. Tissue-borne appliances must be rebased at frequent intervals. When full dentures are seated, they also are a source of discomfort, frequent adjustments and rebasings being necessary. From this type of recession, we get most of our recurrent knife-edge ridges. Roentgenographically, little or no pocket formation is noted, the septums appearing almost normal except for the slight break at the crest. The area of decreased density usually broadens just below the crest, gradually becoming narrower the deeper it goes into the process.

The recommended treatment is very radical. It consists of the removal of the teeth with the trimming of the process

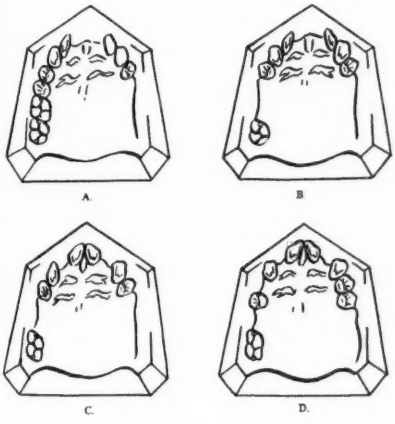

Fig. 5.—Class II cases: *A* to *D*, modifications 1-4, respectively.

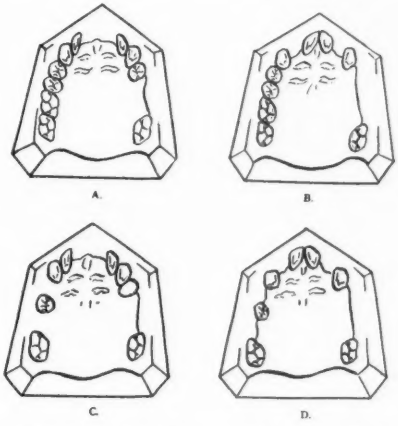

Fig. 6.—Class III cases: *A* to *D*, modifications 1-4, respectively.

below the line of filtration. Otherwise, the ridge will continue to resorb until all semblance of ridge form has disappeared.

The density of the process, both cortical and cancellous, has much to do with the success of a tissue-borne appliance. Of the two, the more important is the cancellous, as the cortical may become less dense if unsupported by dense, even cancellous tissue.

From the information obtained by the foregoing methods, not forgetting a general case history, we are able, in a high percentage of cases, to give our patients a reasonably accurate prognosis of the case.

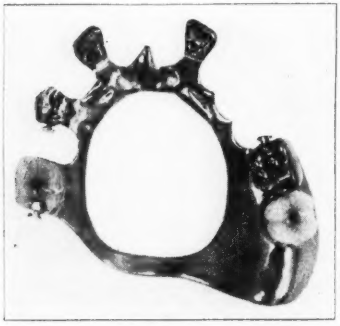

Fig. 7.—Practical case, Class II, modification 4; showing precision attachments.

EXAMINATION AND DIAGNOSIS

The examination can be conveniently divided into: (1) examination of the various oral structures; (2) a health history of the patient; (3) a dental history and (4) a psychologic examination.

The first step, then, will be a detailed examination of the various oral structures. To conduct an accurate examination, we must employ every modern diagnostic accessory. These examination aids should include full mouth roentgenograms, study models, transillumination, probing, percussion, pulp tests and, in indicated cases, a bacteriologic examination of the mouth. A metabolic examination is indicated when the structures of the mouth give evidence of nutritional disturbances. We must keep in mind that it is just as important that the patient maintain the remaining teeth in a healthy condition as it is that the denture be properly constructed.

We will then record in detail the condition of each remaining tooth as well as roentgen-ray findings in the edentulous areas. We must make note of the type of saliva, the general ridge condition in the edentulous areas, the muscle attachments, the condition of investing tissues of remaining teeth, lesions of the mucosa and any abnormality of the structures

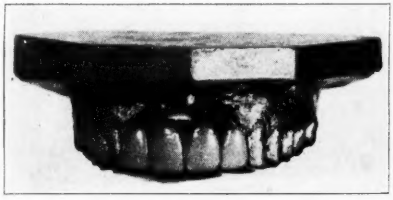

Fig. 8.—Class IV case: four anterior teeth, three-quarter crowns on cuspids; retention by precision attachments.

that might have a bearing on the diagnosis or prognosis of the case.

Having carried out the oral examination to the best of our knowledge and ability, we are ready to secure from the patient a general health history. We can base the examination in part on certain visible clinical symptoms. For example, the coloring of the skin, whether yellowish, pallid, flushed or cyanotic, might be a visible symptom of organic or systemic disorder. Visible reflexes could be noted. Signs of vitality as evidenced in movements and speech are often suggestive of the physical condition. For the most part, we must rely on the patient's word for

this phase of the examination, unless we deem it necessary to request a physical examination by a physician. If the patient is suffering from any serious ailment of which he is cognizant, it will usually be disclosed if the examination is correctly and diplomatically conducted. We must not overlook the patient's conception of his own physical condition.

If the patient has a personal physician, it is our duty to communicate with him in regard to the patient's health. The physician may have information to impart that will materially change the final diagnosis. This cooperation of dentist and physician also has the added value of having a good psychologic effect on the patient. A correct mental attitude on the part of the patient is so important that any steps that will tend to improve it should not be overlooked.

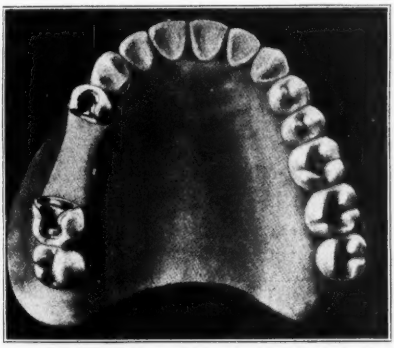

Fig. 9.—Class III case: saddle unilateral; showing cavity preparations.

When we have satisfied ourselves as to the physical condition of the patient, we are ready to secure a dental history. Here, again, we must rely to a large extent on the patient's word. Dental experiences that the patient has had may prove to be very valuable in determining the ultimate diagnosis. This dental history should include anything along dental lines that may affect the end results or aid in the diagnosis.

The psychologic examination is not necessarily conducted as a separate phase of the examination. It has been a part of our health and dental histories. Whenever we engage the patient in conversation, we should be psycho-analyzing him.

It is of utmost importance that we, in some manner, determine the attitude of the patient toward dentistry and the care of the mouth, and also toward specific types of dental restorations. If the mental reactions toward these is not all that we might desire, it is our duty to attempt to change them. This often requires a great deal of diplomacy and tact on the part of the dentist. If the attitude cannot be changed, it must, at least, be allowed for.

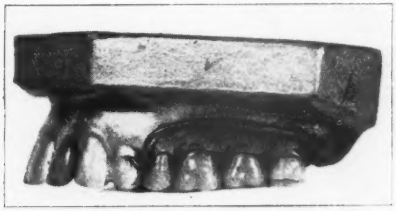

Fig. 10.—Class I case, modification 1. The spear point retainer on the distal aspect of the cuspid adds to the esthetic values of the case.

With the results of the various examinations before us, we are now in a position to make the diagnosis, which is based on the sum of the examination findings. The correct interpretation of the examination and the actual designation of work to be done constitute the diagnosis.

The prognosis of the case is based upon the examination findings and the mechanical limitations with which we are faced in this particular case.

STUDY MODELS

After the ocular, digital and roentgenographic examination of the remaining teeth, ridges and supporting tissues, construction of a set of study models is the next step in completing a diagnosis; upon which can be outlined the work that will be required to restore the oral cavity to normal health and function.

To make an accurate set of study models, a good plastic material or a sectional compound impression should be used. An inaccurate impression that eliminates the undercuts or in any way distorts the structures present is misleading, and often results in a faulty outline and a mistaken diagnosis of the case.

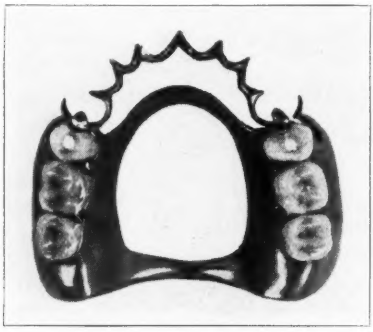

Fig. 11.—Class I case modifications; palatal view, showing continuous clasp design.

In taking the impressions, overextension rather than underextension is desirable, as the casts, to be of real value, should include all of the structures that must be taken into consideration in outlining the case.

The study models should be mounted on an articulator in proper relationship to the condyles, the inclination of the condyle paths ascertained and the articulator set to correspond with the patient's movements.

Care should be taken as to the proper centric relationship between the maxillae and the mandible. Centric cusp relationship is not always true centric, as malocclusion, in some cases, will throw the bite off the normal centric.

With the study models so mounted, the presence of any condition that will interfere with the proper making of appliances, to restore the case, can be noted and the necessary amount of surgery determined.

The study models will disclose the anatomic landmarks which have to be taken into consideration in outlining the case, such as the junction of the hard and soft palate, the retromolar triangle, the mylohyoid ridge, the hamular notch and muscle attachments.

From the number and position of the remaining teeth, and the condition of the supporting tissues and ridges, the mechanics of the restoration to be used are decided on. The problem as to whether fixed or removable appliances are indicated is determined. If removable, the advisability of making the denture tooth bearing, tooth and tissue bearing or tissue bearing is determined.

The mode of attachment, whether with the various types of precision, or nonprecision attachments, such as the bar clasp or contoured clasps, is decided on.

With the aid of a chart and the study models, the power points or resistance areas, the fulcrum point and the load point, or greatest distance from the fulcrum point, are charted, and the teeth to be used as retainers are selected.

The necessary operative work on the remaining teeth is outlined and, with this complete information regarding the case, the operator is in a position to inform the patient as to what must be done to restore the oral cavity to normal health and function.

PREPARATION OF THE REMAINING TEETH; NECESSARY SURGICAL MEASURES

We will now consider the steps necessary to place the mouth in condition for the final impression. From the diagnosis previously made, it has been determined what surgical procedures should be carried out for the success of the restoration and the health of the patient. If extractions are indicated, care should be taken to trim and smooth the process so that a favorable area for bearing the stresses of the partial denture shall be provided. Very often, especially if the upper posterior teeth have been extracted for some time, it is necessary that the tuberosity be trimmed down to allow room for the teeth to be supplied.

The next step should be to place the remaining teeth in the mouth in the best possible condition by restorations in the areas that may be carious and by replacing any faulty dental work in the areas already present. At this time, a careful check is made to determine whether any correction need be made in the occlusion because of the presence of malposed, drifted or elongated teeth or improper restorations. Malposition and drifting of teeth sometimes require operative procedure to restore correct contact and occlusion, and it may be necessary to grind some interfering cusps to relieve a locked occlusion or to add onlays to restore the teeth to occlusion. In certain cases, the inclination of the teeth precludes the insertion of a partial denture unless the position of the teeth is corrected by operative procedure.

If extractions have allowed the opposing teeth to elongate considerably, it is often impossible to get any semblance of balanced occlusion unless the tooth or teeth are extracted or ground enough to give free lateral movement. A denture involving the occlusal surfaces should be in correct occlusion and the normal structure of the mouth restored before it can be considered ready for impressions and relationships. All the contacts between the remaining teeth should be inspected and changed if necessary.

The teeth to be used for abutments now require attention. If the case is to be a precision attachment type, the cavities are to be so prepared as to withstand considerably more stress than ordinary inlays. If rests are to be used in the case, the teeth should be prepared at this time. The rests should be very definite and should be smoothed and polished.

The last step before the impressions are taken is a final scaling and polishing of the remaining teeth.

MODES OF ATTACHMENT

Retention of partial dentures may be accomplished by direct or indirect means. Direct retention may be divided into two classes: precision and nonprecision. The precision attachment is a compound attachment consisting of a male and female part, and may be purchased from the manufacturer according to the type indicated for the particular case in hand. A denture retained by this mode of attachment presents a highly refined appearance, and permits of greater ease in cleansing, because the attachment itself is smaller than any other form of retainer. Also, adjustment is simplified.

It is particularly advantageous in the anterior part of the mouth to avoid a display of gold and in Class I cases where teeth have moved forward making it impossible to take advantage of indirect retention.

We are justified in using this form of retention where teeth have been cut into previously or when decay is prevalent. But there is a question about mutilating a sound tooth for no other reason than to satisfy the desire of the operator to

use a precision attachment, when some other means of retention could be used to just as great advantage. Probably every type of attachment has its indication, conservation of tooth structure being the paramount consideration.

The nonprecision attachment consists of clasp, crib, staple and manufactured attachments.

Clasps, which are nonprecision direct retainers, are probably the most universally used of all types of retainers. They may be either cast or wrought, or a combination of the two. The wrought clasp has the advantage of being more resilient and of having no microscopic recesses, while the cast clasp is more rigid and more accurate. Each has its indication.

There should be a minimum number of clasps on a case for retention, and a minimum of contact area on the tooth. There should be sufficient grasp to retain the denture, but also sufficient resiliency to allow the denture to move on compressible tissue and permit of a certain amount of independent movement of the saddle.

The arms of a clasp should grip the most favorable convex surface of the tooth away from the occlusal interference, taking advantage of undercuts wherever possible, and should also be hidden from view as much as possible, for esthetic reasons. The contact should be in the area of greater immunity.

The cast clasp is indicated where rigid retention is desired, such as in short spaces with suitable teeth to clasp at each end of the space. Wrought clasps are usually contraindicated in these cases because of the danger of displacement.

A great many anchor teeth are lost from torque, owing to the use of cast clasps lacking in resiliency and not allowing individual movement of saddles. Such clasps are usually too wide and too thick, and there is no excuse for such a design.

Under indirect retention, we have occlusal rests, and unless they are used where indicated, the case is doomed to failure. They add to the rigidity of the case and prevent settling into the soft tissues.

The continuous clasp, or double bar as it is sometimes called, as we show on the models is classed as an indirect retainer. The round wire clasp may be so designed as to come under this classification. The nonprecision manufactured attachments, such as the Dresch, Roach and Kayle, have their indications, but the continuous clasp, in conjunction with a well designed round wire clasp, will serve as a stressbreaker.

Other means of indirect retention act by surface and recessed contact only.

The problem as we see it is conservation of tooth structure, proper design, cleanliness and maintenance.

DESIGN

A design of a partial restoration is a mental picture or a mentographic supplemented by a drawing of a proposed restoration, which should be, as far as possible, completed before any material is collected or work begun.

The mental process design involves: (1) a mental storehouse of the pictures of the standardized parts from which a partial denture may be constructed; (2) a knowledge as to their correct use, and (3) examination for discovery of conditions peculiar to the case for a simple working procedure in securing the above mentioned mental or graphic pictures.

Steps and Design.—The hypothesis is that dentists may best learn to design all partial dentures, above a certain grade of difficulty, by a graphic method

in four definite and distinct steps in which preventive considerations continually recur in redistributed order: (1) saddles; (2) parts connecting saddles; (3) direct and indirect retainers and connectors, and (4) occlusal rests, if indicated.

Saddle Design.—In saddle design, we have allocations of load to the mucosa. At this stage in the design of saddles, the mucosa is given its share of the load. The softer the mucosa, the larger the saddle should be. A slight intermittent pressure is more favorable, a steady pressure in excess interfering with the circulation. In outline, the saddle should be kept away from the gingival margin. Unless there is proper loading of the mucosa and of the teeth and correlation of saddle and tooth movement, partial dentures will continue to injure teeth.

Parts Connecting Saddles.—At this stage, the mucosa is sometimes also given a share of the load. These parts are almost always located toward the lingual aspect of the teeth, and occasionally buccally and lingually. The two most common parts connecting the saddles are palatal bars and lingual bars. When the palatal bar is used, the outline should start at the location of the first and second molars and run backward in a nice flowing line opposite the third molars and across the median line of the palate at the junction of the hard and soft palates. It should rest upon soft tissue to allow for settling. In fact, the bar should cross the mouth on exactly the same line that the postdamming does in an upper full denture, and if any settling does take place, the edges of the bar settle against the tissue sufficiently to be lost and not felt by the tongue.

Positions and Choice of Retaining Devices.—With the exception of precision attachments, the clasp or retainer of smallest dimension consistent with efficiency to reduce capillarity is preferred. All retainers should be placed in locations where they will not cause torque.

Connectors.—These are of any form and are used to connect the retainers.

Position and Choice of Occlusal Rest.—With the occlusal rest, we have allocations of load to the teeth. Load must be applied to teeth coincident with their long axes only. Occlusal rests throw the bulk of the stress on the teeth, and teeth having a shrunken or diseased pericementum and certain isolated abutments should not be given this duty.

In designing partial dentures, all of the above mentioned factors must be taken into consideration. The improper use, design or placement of any one of them may cause a failure. They must all be considered as a single unit in designing a partial denture as any one of them plays just as important a part in the success or failure of a partial denture as do the others.

Let us remember that all saddles must be properly placed and free of the gingivae; all connecting parts be in proper relation to the saddles and in an area of efficiency in the mouth; all forms of retention be of the smallest dimensions consistent with efficiency and placed so as to cause no torque, and all occlusal rests applied to teeth coincidentally with their long axes only.

IMPRESSIONS

One of the most important steps in the mechanical phase of partial denture construction is the securing of as nearly perfect an impression of the remaining teeth and tissues as possible. Let us consider first the definition of a dental impression. It is the negative likeness of the maxillary or mandibular arch in some plastic material, such as plaster, wax, compound or colloidal material. The

next step is the ability to reproduce this negative likeness in a positive cast with as little change from the original as possible.

Any one of several impression materials may be used, and it is well to take into consideration the advantages and disadvantages of each.

Plaster of Paris.—According to Dr. Kennedy, in his book on partial dentures, plaster of Paris is probably used in dentistry more than any other material. When used alone, it has the following disadvantages: 1. It lacks stability, unless properly confined. 2. It expands rapidly on initial set and contracts as it dries. 3. It does not lend itself to muscle trimming. 4. When it is used, saddle compression cannot be obtained.

Its main advantage is the possibility of securing sharpness of outline and accurate detail. For contouring clasps, its use with a split tray gives very satisfactory results. Plaster of Paris or other plaster materials may be used in combination with compound, and thus some of the disadvantages stated above can be avoided.

Waxes.—Waxes are sometimes used in impression work, but their use alone should be discouraged as they are not constant in their composition, the base being largely of beeswax, and they are very hard to control in operation. Soft wax, such as counter wax, when used in conjunction with firmer materials, is often useful in securing additional compression in certain areas.

Compounds.—Compound in the hands of the average dentist can be used much more satisfactorily than either plaster or wax. This material has a number of natural advantages, such as: (1) the possibility of securing tissue compression; (2) adaptability to muscle trimming; (3) cleanliness, and (4) ability to secure an impression under biting stress.

The chief disadvantage is the difficulty of securing accurate impressions of undercuts.

Colloidal or Plastic Materials.—In recent years, a number of colloidal or plastic materials have been placed on the market. One at least has proven merit, while others have been forced on the profession before accurate and scientific research has established their value.

Dentocoll is a colloidal material that has been before the profession for about seven years and its accuracy when properly manipulated has been proved.

The advantages of this material are: (1) ability to secure accurate impressions of excessive undercuts without distortion; (2) adaptability to securing duplicate impressions of master casts; (3) pleasant taste; (4) removability from the mouth in one piece, and (5) ability to secure an impression of tissues in totally unstrained relations.

Conditions to be avoided in the use of colloidal material: 1. Using material that is too old and has lost some of its elastic properties, as this causes bubbles or checks in the impression. 2. Removing the impression before it is properly chilled. 3. Permitting the impression to stand too long before pouring the cast. 4. Loss of moisture from the material while the cast is setting when using a slow setting stone. To avoid this it should be wrapped in a moist towel. 5. Using material that is too hot. Best results are obtained when the material is quite cool and, when placed upon the tray, will retain its shape.

In the use of any material, close adherence to the manufacturer's instructions is essential if good results are to be secured.

To secure good impressions with any

material, the operator must give great care to detail, following each step of the given technic with accuracy, and must be willing to place at least part of the blame for failure on his own lack of skill or experience rather all on the technic or the material. In our work, let us not be satisfied with an impression that is not just what it should be. Thought as to the proper material and the technic should be given each case, taking into consideration the difficulties of each; for one method will not solve all problems.

New materials and new procedures make for progress, but the profession as a whole is too prone to use new untried methods and unproven products. In the hands of one man, a material may give good results while others require something quite different. The secret of successful impressions is to find a material and a technic which adapt themselves to our individual needs and, with care and patience, work out the details until they are as near perfection as we can make them.

CONSTRUCTION

Assuming that an accurate impression has been obtained, we are ready to pour the impression with a good, dense investment material suitable for casting directly to it, the direct method being considered the more accurate, for obvious reasons. It is deemed advisable to secure another model from the working model for finishing purposes.

After the models have set for a sufficient length of time, they are separated and the working model occluded to the opposing one and placed on a suitable articulator. We are then ready to proceed with the design of the case.

The cases in this clinic consist of both precision and nonprecision. By "precision," we mean those cases that have the male and female attachments, and by "nonprecision," those that are held in place by clasps and their variations, the cast clasp and the wrought clasp.

The case is outlined with a pencil to include the body of the case, or the area to be included in the finished case exclusive of arms and attachments.

If it is a large upper palatal case, a palatal bar is included in the design at approximately the postdam area. This palatal bar strengthens the case from lateral stress and permits us to make the remainder of the case lighter, thus rendering it more tolerant to the wearer.

The extent of the areas to be included in the saddles depends on the size of the case and design and the condition of the underlying tissues. Around the periphery, on the palatal side of the saddle areas, it is advisable to scrape the model slightly, thus giving an additional seal to the finished case.

The arms, if they are to be used, are next designed. These must be as long as possible in order to give sufficient flexibility.

The next procedure concerns the design of the modes of attachment, as to whether they are to be precision or nonprecision and whether the case is to be all tissue bearing, tooth and tissue bearing or all tooth bearing. If it is part tooth and part tissue bearing, the rests must be placed at the most advantageous points. Where possible, the case should be so designed that, at the fulcrum points, we have balanced stress. For instance, if stress is placed on the molar region on one side, it is well to place the counter stress in the region of the opposite cuspid, and vice versa, so that the fulcrum design will be approximately a letter x.

The teeth are selected as to type, form and shade, then ground to the

ridge, one thickness of 28-gage wax being left between the teeth and the ridge of the model. The teeth next to the abutment teeth should be grooved to allow for the truss arms and rests. With the teeth in place, waxing is the next procedure. Over the saddle areas and palatal bar region, two thicknesses and, around the entire periphery and palatal bar, an additional amount of wax, should be added. This is done so that when the case is finished a blunt or round edge may be made. Of course, copings should be made for tube teeth, if they are to be used. The arms should have at least two thicknesses of wax.

Not much need be said regarding spruing, except to use plenty of sprues, and a small ball of wax about one-quarter inch away from the case should be added to each sprue; which reduces the shrinkage of the metal to a minimum. The case is next washed with liquid soap to remove any grease or oil from the wax. The case is soaked in water for a few minutes before investing. No particular investment material is recommended, but it is advisable to use the same that was used in the model originally.

Wax elimination, which is very important, should be carried out in an electric oven on low heat for a long period of time. After that, the case is brought to a red heat and cast at once, two hours or more being allowed for the burning out.

If the precision case is to be dealt with, the design is practically the same, except that male and female attachments are to be used instead of arms, bars and clasps. Inlays are prepared to receive the female portion of the attachments. These should be as nearly parallel to each other as possible. An impression is then taken with the inlays in place and poured in a stone model. Before pouring, seats for the inlays have been poured with a fusible metal. After obtaining the cast, it is articulated with its opposing cast and placed on an articulator. By means of a buccolingual mandrel on a parallelometer, the female portions are waxed in place to the inlays. They are then removed and soldered, and the male portion is fitted into the female portion. The saddles are waxed and cast, and fitted into place, the cast is assembled and the portions are all soldered together.

No definite set rule can be given out regarding the handling and melting of the gold for casting, but, from the Bureau of Standards and our own experience, we can give some helpful suggestions. According to the Bureau of Standards, in melting gold alloys, gas and compressed air are the safest combinations, to avoid superheating. Many other combinations are good; for instance, acetylene and air, oxygen and gas. The main point is to know something of the physical properties of the alloys and the properties of the flame used and its limitations.

The golds best suited for this type of work are exceedingly hard, with a high yield point and high tensile strength, in order to resist the stress of being handled by the patient and the slight flexures that take place in mastication.

After the cast is approximately finished, it should be heated to a dull red and plunged into a water bath. This gives the advantage of elongation, as well as high tensile strength and a high yield point.

PHYSIOLOGIC IMPORTANCE OF BALANCED OCCLUSION

The necessity for "balanced occlusion," either unilateral or bilateral, is

obviously the same whether the case requires partial or full restoration. If proof is needed, one need only examine clinically and roentgenographically any natural dentition showing the malposition of several or all of the teeth. The picture here encountered shows a marked deterioration in both the soft and the hard tissues. This is in decided contrast to a normal alinement wherein the various stresses are in harmony.

Similarly, if we carry out a restoration which embodies the principle of malocclusion and observe the tissues shortly thereafter, redness, irritation and pain will be evident, all typical symptoms of inflammation. If the cause of this condition is not removed, over a longer period the soft tissues will take on a decided lack of tone, shrinkage and general flabbiness. To expect this to serve as a satisfactory denture base is asking too much.

The roentgenograms in the early stages of the malposition will probably indicate very little in the way of change in the bone structure; but, as time goes on, and a comparison of later pictures with earlier ones is made, a rather startling change is viewed in the process bone. We find density lessened and the ridges absorbed and uneven. That in itself also is enough to make more difficult or destroy entirely the possibility of a balanced, well alined case later on.

In dealing with partial restorations, as we are here, and accepting the importance of balance as absolute, we will find several satisfactory results if our plan is carried out:

1. In the first place, "function" is greatly enhanced, and that as a primary requirement of any denture is too obvious to need justification. Any mechanical appliance functioning smoothly and easily will work better, last longer and show less need for adjustment in itself and in its correlated parts than will one lacking these attributes.

2. When the partial or full restoration has this balance of occlusion with the accompanying maximum of function, there usually follows naturally a sense of "comfort" to the one wearing it; comfort in the area of the denture and a peace of mind in not being conscious of its existence as a separate entity. Also, the problem of retention is simplified because the balanced case is less easily dislodged in the normal muscular movements.

3. "Esthetics" may be considered in discussing balanced occlusion. Such a case will, in every instance, be more pleasing to the eye, because it is the usual and normal rather than the unusual and abnormal which we like to see.

INSTALLATION AND FINISHING

The installation, finishing and final articulation of partial dentures are phases of partial denture work that are often given inadequate attention, both in the office and in dental literature. A perfect impression, and painstaking design and construction will avail us little if the final stages, namely, installation, finishing and final articulation, are not carried out with the same care.

In discussing this subject, let us assume that a cast partial denture has been constructed by any one of the popular methods in use today. Installation will begin with the fitting of the casting to the mouth or, if a master model has been used in its construction, the denture should be fitted to it before being carried to the mouth of the patient. At times, when we try to seat a casting, it will bind, owing to some minor discrepancy and will not go comfortably to place. This binding effect usually occurs on the

sides of the casting contiguous to the abutment teeth. Great care should be used in locating the exact spot that is causing the trouble before grinding is resorted to. When the obstruction occurs in a location that it is difficult to see, it may necessitate forcing the case to place so as to form a shiny spot on the gold, which can then be readily located and relieved. If the trouble is not found in the body of the casting, it is usually due to a binding of the retaining parts due to the presence of bell-crowned or leaning abutments, but if the retaining parts were properly alined, this should not occur. If minor adjustments will not seat the case comfortably, it should be made over with more care given to alinement, casting technic and assembling, as the distortion or discrepancies are usually due to a fault in one or more of these three phases.

After the case can be seated, the soft tissues of the mouth should be examined for any undue pressure, which, if found, should be relieved. A casting that fits properly should sit firmly and comfortably upon the tissues and the occlusal rests should go accurately to place. After the case is seated, the occlusal rests should be examined by means of articulating paper and, if interfering with normal function, should be relieved.

The next step to consider is the correction of occlusion. The porcelain teeth are placed in position and occlusion and articulation corrected. All high spots and interference that have not been corrected before this stage should be cared for at this time. Great care should be exercised that no interfering surfaces are overlooked. After any interference is relieved, the incisal and occlusal surfaces should be restored to contour by the replacing of ground away cusps and grooves in the porcelain with small stones. It is necessary at times to build on porcelain to these surfaces to gain proper interdigitation, and if this is necessary, it should be done by all means. If there is not proper interdigitation in the cuspal portion of the teeth, an abnormal stress will be thrown on the opposing teeth and a great deal of damage will result to the teeth and tissues in the future. After the teeth have been restored to occlusion and proper articulation, the porcelain should be reglazed or given a high polish. Failure to recarve occlusal surfaces after grinding greatly decreases the efficiency of the supplied teeth and also throws a greater strain on the denture, abutting teeth and tissues owing to the fact that two flat surfaces demand an excessive amount of pressure to enable them to crush fibrous foods and, the cutting action of inclined planes and convex surfaces being absent, a crushing action is all that can be anticipated if this phase is neglected.

At this time, the patient should enjoy complete comfort with the denture in place. If there seems to be any doubt in the patient's mind, it is advisable to recheck the steps until the source of the discomfort is located and the patient gives a positive answer as to the comfort of the appliance. The denture now being ready to be placed in the mouth, it is advisable, as a final precautionary measure, to note the tension of the retaining parts, thus making sure that they are neither too tight nor too loose on the abutments so that the denture may be inserted and removed without difficulty and still remain firmly in place.

When the patient is dismissed, definite appointments should be made to reexamine the completed case until the dentist is confident that the case is satisfactory, and the patient should be told not to remove the appliance before re-

turning for the next appointment, on the following day.

The above mentioned phases of denture construction, if properly carried out, will mean much by way of continued comfort and service to the patient and the minimum of difficulty and denture "servicing" to the dentist.

MAINTENANCE

Maintenance is one of the most important phases of service to the patient, yet probably the most neglected. Many times, we construct an appliance, fit it and send the patient on his way, neglecting to give instructions as how to take care of the appliance, what he is to expect of it, when to return and the importance of returning at intervals for reexamination of the partial denture and the remaining teeth in the mouth. Much trouble and loss of confidence in the dentist could be avoided if this step were given more consideration.

First of all, we must instruct the patient as to how to clean his appliance and the importance of cleanliness. He should be told that although the metal and other metals used are highly polished, mucus, food, etc., will accumulate and actually adhere tightly to the appliance, if it is not properly cleaned every day. In most partial cases, a tapered brush is indicated to clean around the retainers and occlusal rests. The brush that is used to clean the remaining teeth in the mouth will probably suffice to clean the remaining part of the denture. There is no call for an array of brushes: these two will take care of most cases. The patient may use the same dentifrice to clean the appliance as he uses in the mouth. When the appliance is scrubbed it should be held firmly in one hand over a bowl with a little water in it. It is a good plan to fold a wash cloth and let it lie in the bottom of the bowl. In case the denture slips out of the hands, the water and cloth will help prevent any damage. At the time of cleaning the appliance, the remaining teeth in the mouth should be thoroughly brushed, with special attention to the tooth surfaces with which the cases come in contact, such as occlusal rests, and its supporting member, and clasps, bars, etc. Many patients neglect the surfaces of the teeth which are proximal to the edentulous spaces.

The patient should be instructed to clean the appliance thoroughly before going to bed and to leave it in the mouth. Many patients have the habit of gritting the teeth during sleeping hours. If the denture is left in during the night, any undue trauma on the remaining natural teeth will be prevented. This will also prevent the unnatural feeling that patients who leave their dentures out during the night complain of for an hour or so in the morning.

The patient should return at six-month intervals so that the dentist can examine the case at the time of the regular prophylactic treatment. Many times, the patient will neglect to return as instructed, not wishing to take the time and be told by the dentist that his case is all right, which he already knew, or to find that some other trouble exists, which he is not in the least eager to hear. This does not mean that the dentist is responsible for trouble arising from the patient's neglect. On the contrary, it should be understood that the dentist's duty does not include such extraneous services, but merely a reexamination as to performance and function of the appliance.

Balanced occlusion we know is a necessary factor in appliance comfort and satisfaction. Any change or any possible error at the time of dismissing the patient

must be looked for, as they are easily overlooked. Rebasing or relining a denture is sometimes necessary owing to normal absorption of the underlying tissues, which would naturally cause faulty occlusion. This trouble can be overcome by the periodical examination.

Let us bear in mind that the patient is not buying a piece of merchandise such as a suit or a pair of shoes, or even some teeth with a piece of gold or rubber attached to them: these can be bought any place at any price. The proper fitting of partial dentures is indeed a service to the patient. It is the dentist's duty to his patient at all times to be anxious to know whether the denture is functioning properly, and he should continue his efforts to have the patient come in at regular intervals.

OSTEOMYELITIS OF THE BONES OF THE FACE; DIAGNOSIS AND TREATMENT*

By EARLE H. THOMAS, M.D., D.D.S., LL.B., F.A.C.D., Chicago, Ill.

TYPICAL infectious osteomyelitis indicates an overwhelming of the resistance of the bone tissue by invading organisms, and as this occurs suddenly, there is no immediate localization or walling off of the infection, which spreads rapidly until almost the entire internal structure of the bone is involved, when there occurs a breaking down of the tissue with resultant pus formation. (Figs. 1-3.)

The main symptom is deep seated excruciating pain as the infection rapidly spreads through the bone. It may take two or three days for the whole interior of the bone to become affected, and during this time there may be practically no objective symptoms. If the infection has started from a pulpless tooth, that tooth may be especially painful and slightly loose but with practically no roentgenographic indications of bone destruction around its apex. In a few cases, and especially in children, the infection may be hematogenous or it may be the result of extension from subcutaneous infection, and, if so, the pain is not localized in any particular tooth. Sometimes, the infection seems to have entered the bone from beneath the gum tissue around a vital tooth unaffected by gingivitis, and, in such a case, that tooth may get very sore without sufficient objective or roentgenographic evidence to warrant the conclusion that there is a pathologic disturbance around it.

In typical cases, three or four days may elapse before all of the teeth become painful and loose and, from then on, absorption of the calcium salts of the bone progresses very rapidly, with all of the teeth becoming so loose that one would think that they might almost fall out or could be picked out with the fingers.

About this time also, a severe general reaction may ensue owing to absorption of toxins. The temperature and pulse

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rate may be quite high and the patient may become alarmingly toxic. The general condition should, of course, have appropriate treatment, which should, in most cases, be under the control of a physician.

The unscientific local treatment which is often given in such cases of osteomyelitis consists in extracting the first tooth that becomes painful and loose, then the next one when it gets loose, etc., until several teeth have been sacrificed, and with no beneficial effect on the course of the disease.

In my opinion, the therapeutic procedure which is most conservative and

Fig. 1.—Osteomyelitis of entire mandible.

most effective is a buccal or labial horizontal incision in the region of the apical third of the roots of the teeth and extending past two or three of the teeth adjoining the starting place of the infection.

This incision should go through the periosteum, which should be stripped from the surface of the bone to expose a very large area, extending almost to the lower border if in the mandible. This area of bone should be kept exposed by packing iodoform gauze over the surface. If the infection should continue to spread throughout the whole jaw, the incision should be extended from the third molar all the way around to the opposite third molar, the periosteum being stripped back over this entire area as previously described.

Such treatment usually gives marked relief from pain and general symptoms because of the usually efficient drainage which is established through the multitudinous small openings normally penetrating the outer cortical plate of the jaw. If sufficient relief is not obtained by this procedure, more efficient drainage may be established by drilling several holes through the cortical plate, but this has not been found necessary in any cases that have come under my observation.

Up to this time, four or five days or more may have elapsed with practically

Fig. 2.—Osteomyelitis of anterior region of mandible.

no pus formation. From now on, there may be a profuse formation of pus which will drain through the cortical plate from the interior of the bone. The outer plate is kept exposed by the iodoform gauze until all pus formation ceases, when the packing is decreased in size as rapidly as the outer plate becomes covered with granulation tissue. Where such tissue does not grow out on the surface of the bone, the outer plate is necrotic, and it must be kept exposed until Nature separates it, forming a sequestrum, which may take a month or more. After all sequestra have been removed, the tissues are allowed to heal.

No mention has been made of remov-

ing any teeth. I stated that during the first three or four days of the progress of this disease, there may be no abnormal roentgenographic findings. It takes longer than that for the calcium salts to be absorbed from the bone tissue and, until this takes place, roentgenograms do not afford much information. A week or more after onset, they may show that the calcium salts are almost entirely absorbed from around the roots of many or all of the teeth, the roots appearing to penetrate a cavity in the bone. One or all of the teeth may not respond to a vitality test at this time. Even this information is not sufficient to warrant one in advising the removal of teeth.

This is a stage of the disease process that seems to be most misunderstood. If

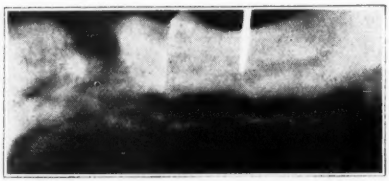

Fig. 3.—Osteomyelitis of entire body of edentulous mandible following removal of cuspid tooth.

the teeth have not been removed prior to this time, many dentists will now come to the decision to remove all of the teeth, a procedure which is *not* to be advocated. Do not misunderstand me: a clinical examination at this time may be sufficient to condemn certain teeth, but, in general, there is no way of determining which teeth can be kept in the mouth in a healthy condition until Nature has had time to redeposit calcium salts in the structure of the bone, and this may not occur to a sufficient extent to be demonstrated roentgenographically for six months or more. Even where there has been a detachment of the pericemental membrane, the cementum remains vital for some time and may become reattached.

When pus formation has ended, the loosened teeth will gradually tighten in their sockets and, unless unfavorable clinical symptoms appear, one should usually wait about six months before roentgen-ray examination. After that time, teeth that show a lack of deposition of calcium salts around their roots may be condemned by the same clinical and roentgenographic procedure that is used in other chronic infections. In many cases, one will find that, if the above

Fig. 4.—Above: Development of osteomyelitis around first bicuspid apparently from gingival infection (second day of symptoms). Below: Same case, seventh day. The infection could not be stopped and eventually involved the entire mandible.

described type of treatment has been followed, all or practically all of the teeth will be in a normal, healthy condition and with a normal pericemental membrane. (Fig. 5.)

Why and how is this possible? I might illustrate it in this way: If we take a long bone and immerse it in a weak acid solution for a sufficient length of time, all of the calcium salts will be

dissolved and the bone can then be tied in a knot. If such a bone is roentgenographed, it makes very little shadow—no more than a thick layer of soft tissue would make—but if we make sections of this bone and examine them microscopically, we will still find the bone structure present, only the calcium salts being absent.

Somewhat the same procedure takes place in osteomyelitis. The severe and extensive reaction to the virulent infection causes an absorption of the calcium salts from the interior of the bone so that roentgenographically no bone trabeculae can be demonstrated, yet the structure of the bone is still present. Just where this normal structure is presen

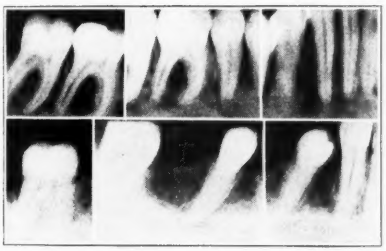

Fig. 5.—Above: Osteomyelitis of right side of mandible. Below: Same case, two years later. The first bicuspid and first molar had to be removed. The bone regenerated normally around the remaining teeth.

or absent cannot be demonstrated roentgenographically until there has been a redeposition of calcium salts. Where calcium salts are not deposited, we may infer that the normal structure of the bone is absent, but this cannot be demonstrated roentgenographically until possibly six months after resolution of the disease process.

As regards the lack of value of a pulp tester in this condition, I refer you to the situation arising where there has been an alcohol injection for the treatment of neuralgia. After such an injection, pulps will usually not respond to a vitality test because there is no conductivity of the nerve tissue, but the pulps remain vital. Similarly, in osteomyelitis, the conductivity of the nerves may be affected and the pulps remain vital but not respond to a pulp tester.

I have previously mentioned removal of the sequestrum, but there are times when the sequestrum is not removed as soon as it has separated from the living tissue. I refer principally to cases in which a very large area of the maxilla

Fig. 6.—Necrosis of right side of mandible due to osteomyelitis following removal of acutely infected deciduous tooth, in a child, aged 7 years. The sequestra involved were left in situ for several months to hold the periosteum in its normal position. (Compare Fig. 7.)

or mandible, and especially the latter, becomes necrotic, for instance most of the ramus, or an entire section of the body. If this sequestrum is removed, the periosteum will collapse, with resulting disagreeable deformity unless a splint of vulcanite or other foreign material is made and placed in position to

preserve the periosteum in its normal contour until it has built up a sufficient layer of new bone to restore normal bony contour. In such cases, what better splint can we find than the sequestrum itself which is of proper size and shape? In such cases, the sequestrum is left *in situ* until there has been sufficient deposition of new bone tissue, after which it is removed. During this time, of course, sufficient drainage must be maintained to avoid the formation of pus and to prevent the absorption of toxins into the general system. (Figs. 5-7.)

The foregoing is the general routine

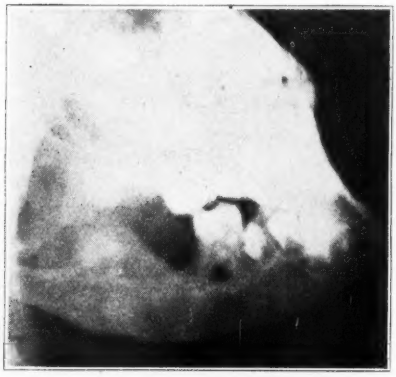

Fig. 7.—Case shown in Figure 6; one year later. The right side of the mandible is rebuilt with new bone to practically normal contour.

in ordinary acute infectious osteomyelitis. In specific osteomyelitis due to syphilis, a more chronic condition, the severe pain characterizing ordinary osteomyelitis is usually absent. In these cases, the same routine of treatment is applied, in conjunction with general anti-syphilitic treatment. The bones of the hard palate are the ones most frequently affected by syphilitic necrosis and the incision in such cases is, of course, over the hard palate.

Chemical poisoning, phosphorus for instance, also is the cause of some cases of osteomyelitis. These are usually very chronic and progressive.

One can hardly discuss acute infectious osteomyelitis without at the same time differentiating it from other types of infection of the bones.

An ordinary acute alveolar abscess in its incipient stage is somewhat similar to osteomyelitis, but, in the abscess type of infection, Nature's resistance is such that the area of infection is immediately walled off from the bone surrounding the affected area, and is therefore limited in extent. The pain is usually localized to one tooth, and the general symptoms are usually much less severe. There is also a rapid breaking down of tissue, with pus formation. In the first stage of this type of infection, treatment is directed toward drainage of the infected area in the simplest possible manner. Drainage through the root canal of the tooth, if this can be accomplished, would seem to be the most desirable procedure, the tooth being removed after the acute symptoms have subsided. If root canal drainage is impractical, the tooth may be removed at once.

If adequate drainage is not obtained, the infection, if it continues to spread, will usually make its appearance through the buccal cortical layer of the bone, and this will be first manifested by swelling of the buccal or labial tissues with possibly considerable swelling of the face. As soon as the face begins to swell, the severe pain subsides owing to decrease in the pressure of the secretions, a pressure which may be considerable while the infection is confined in unyielding bony walls.

In a few hours after invasion of the soft tissues, the face or lip may present an extreme swelling. At this early stage of soft tissue infection, there is usually no pus formation under the swelling, and lancing, although it may sometimes

be beneficial, may at other times be followed by a serious spreading of the disease process.

Usually, about three days must elapse before there is a breaking down into pus of the involved soft tissues and a walling off of the infection from the surrounding soft structures. Fluctuation under gentle palpation is the sign of pus formation and, at this stage, the area may be opened and a gauze drain inserted. The opening should not be a small puncture but a generous incision, and it is not made toward the middle of the swelling because the pus is not located in that area. Even under an immense swelling, there may be only a small quantity of pus and this will usually be located between the periosteum and the bone. The incision is made on the buccal or labial aspect horizontally toward the bone along the line where the swelling begins. The incision is made through the periosteum, and when contact is made with the bone under the incision, the periosteum is stripped toward the apical region opposite the tooth causing the trouble, and, in most instances, this is where the pus will be found. After this pus is drained, the incision is not allowed to close because, for a few days, there will be a continuous breaking down of tissue with new pus formation. The opening is kept open with drains, usually iodoform gauze, until all pus formation has ceased. In the discussion of this stage of swelling of the soft tissues, no mention has been made of removing the tooth. After the lip or cheek has become considerably swollen, the most serious infection is now in that region, and removing the tooth at this stage will usually not be beneficial, and may cause harm. Therefore, the removal of the tooth is delayed until pus formation in the soft tissues has subsided.

I have stated that, in cases of swelling of the soft tissues, the pus will usually be found under the periosteum in contact with the bone. Pus may be in contact with bone for several days and the bone still live. If the condition has been neglected or insufficient drainage has been obtained and pus is in contact with the bone longer than a few days, the cortical plate of the bone which has been in contact with the pus may die. In such a case, Nature will have to separate this dead bone from the living, and this process may take from three to six weeks. In such a case, drainage must be continued until the sequestrum has separated and been removed.

In the foregoing discussion, I have had in mind infection spreading through the bone buccally into the cheek and labially into the lip, and I might add that infections in the upper lip are especially dangerous to life because the venous drainage from that area is upward and through the vessels that traverse the brain. In infections starting from the upper lateral incisors, the swelling frequently involves the tissues of the palate lingually to these teeth and the incision must, of course, be made in this region.

In children, infection arising in lower teeth, instead of travelling buccally or labially, often finds the path of least resistance to be toward the lower border of the mandible. Even in adults, infection from the lower second and third molars often travels lingually or toward the lower border of the mandible. In such cases, most of the swelling may be in the neck and lower part of the cheek, and the same general principle of incising is followed, but the approach is from the lingual aspect. The incision is made against the bone on a line where the floor of the mouth or the lingual swelling joins the normal lingual soft tissues, and the periosteum is stripped downward until the pus is reached, even if

this should be all the way to the lower border of the mandible. The removal of the tooth which was the original cause of the trouble should, as previously mentioned, be delayed until the acute stage of the infection has subsided. Regardless of the size of the swelling in the cheek or neck, the foregoing procedure is the one carried out in conditions such as have been described. No mention has been made of external incisions because, at this stage of these typical infections, such incisions are practically never necessary.

Ludwig's angina cases are not handled in this manner, but 98 per cent of the cases diagnosed as Ludwig's can be treated successfully by the foregoing procedure. Infected fracture cases are treated in a similar manner. I might also mention that gravity has nothing much to do with the efficacy of drainage and that even though pus formation may extend almost to the clavicle, it may often be drained successfully from inside the mouth.

If infections as above described have been neglected or drainage has been inadequate, pus keeps accumulating, and more and more of the soft tissue becomes broken down until, through palpation, one determines that there is just a thin layer of skin tissue over the accumulated pus. Then, and only then, is an external incision indicated, in the vast majority of cases. At this stage, not only is an outside incision indicated, but it is also indicated without further delay, if an unsightly scar is to be avoided. An incision at this time will preserve the skin tissue, which will subsequently reunite without appreciable scar formation, but if the process is allowed to continue until an area of skin has been destroyed, an unsightly scar is liable to be the consequence. I might mention here that even in such cases, a competent oral surgeon should be able to remove such a scar surgically by a plastic operation. This is a phase of oral surgery that is not given sufficient attention.

In most of these cases, where neglect or inadequate treatment has made external incision imperative, the bone that was in contact with the pus will be found to be dead and, in such cases, drainage will have to be continued until the sequestrum has separated and has been removed.

Along these lines, I might, in closing, present the economic angle. When infection has caused a swelling of the gum tissues around a tooth, we might still allow the laity to refer to it as an "ulcerated tooth"; but when the cheek, lip or neck has become swollen, the condition is no longer an ulceration of the tooth, but an acute infection of the cheek, lip or neck, a serious condition which may eventually cause the marring of facial beauty or even the loss of life. The operator, in accepting the treatment of such a case, is assuming a very grave responsibility. There should always be an "education" of the patient as to the possible consequences in all such conditions. The fee should be definitely agreed upon in advance, and should be at least commensurate with the responsibility involved.

In presenting this paper, I have tried to avoid all semblance of scientific technical discussion, but have endeavored to give you a scientific basis upon which we can proceed with confidence in handling these unpleasant cases. To the oral surgeons present, I apologize for not presenting something new and startling, but I would have them appreciate that this paper was meant primarily to be of some slight assistance to the average general practitioner.

DISCUSSION

Theodor Blum, New York City: The discussion of Dr. Thomas' paper must be confined mainly to two points: (1) causes and prevention and (2) treatment. I must state frankly that, in accordance with my experience, a very appreciable number of cases of osteomyelitis are due to maltreatment. To prevent such cases, the specialist and the general practitioner of dentistry must be taught a few things—first of all, asepsis in every one of the many links of the chain which make up dental and oral surgical treatment, beginning with prophylaxis, the preparation of a cavity, root canal therapy, extraction, etc. The practitioner must be taught that a lack of knowledge and understanding is indicated if he curets the socket of a recently extracted tooth on account of pain; a procedure which to my mind has caused the development of a large number of cases of osteomyelitis. As far as the treatment of osteomyelitis itself is concerned, the practitioner must also learn the uselessness of extracting a tooth during an acute purulent periostitis, usually called an alveolar abscess. We cannot at this point go into the discussion of this misnomer. In 1923, in a paper on osteomyelitis of the jaws read before the American Society of Oral Surgeons and Exodontists,[1] I stressed the importance of conservative treatment of osteomyelitis. Especially during the initial stage, the infection is extremely virulent. The patient should be given every chance to build up his resistance and nothing must be done to retard this or break it down by premature operative interference such as extraction of teeth, probing or lack of gentleness in examining the involved parts or in changing dressings. I do not believe in making incisions anywhere or for any purpose but the evacuation of pus; nor in stripping off the periosteum for any other purpose, as it endangers the patient's progress and maybe his life, as any unnecessary interference would. The opening of the cortical plate I have never had occasion to resort to. It seems quite important to me to reexamine the affected areas by the roentgen rays about every three weeks. This procedure is quite an important guide as to the progress of the disease and to treatment of the case. Any one of you who wish to read an instructive treatise on osteomyelitis of the jaws, I wish to refer to an article by Wilensky.[2] The article is excellent, particularly if one considers that it was written by a general surgeon. There are only a few points which seem to me not quite in accord with accepted dental or oral surgical views.

1. Blum, Theodor: Osteomyelitis of Mandible and Maxilla, J.A.D.A., 11:802 (Sept.) 1924.

2. Wilensky, A. O.: Arch. Surg., 25: 183-237 (July) 1932.

ADVANTAGES AND DISADVANTAGES OF STOCK APPLIANCES AS COMPARED WITH THOSE ESPECIALLY CONSTRUCTED FOR THE CASE, FROM A BIOLOGIC STANDPOINT*

By WALTER H. ELLIS, D.D.S., Buffalo, N. Y.

A CASUAL consideration of the title "Advantages and Disadvantages of Stock Appliances as Compared with Those Especially Constructed for the Case" might lead to the conclusion that comparison was to be made by illustration and slides between beautiful custom made appliances and the usual mail order laboratory or supply house product that includes full treatment instructions. After the exposition the audience would be expected to see the obvious, and prefer the

*Read before the Section on Orthodontia at the Seventy-Fourth Annual Session of the American Dental Association, Buffalo, N. Y., Sept. 14, 1932.

pretty pictures. This presentation would be easy, but any conclusions drawn from it would be rather casual and certainly empiric. An intelligent interpretation of the general subject would seem to be one of logic rather than of illustration. Therefore, I have added to the original title printed the phrase, "from a biologic standpoint."

The dental journals contain countless illustrations of each type of appliance, the well-made esthetic appliance and its opposite, both in the scientific pages and in the advertising sections. This recorded literature carries a story or teaches a lesson only as our own intelligence and knowledge of orthodontia in its broad sense leads us to the proper concept of the principles involved and a correct interpretation of nature's laws considered from the biologic aspect.

In this discussion, stock appliances will be understood to be those made by laboratories, when the maker has not received adequate instructions from the practitioner, and the ordinary supply house appliances made by the inexperienced. The appliances especially constructed for the case will be understood to be those made up by, or under the immediate supervision of, the orthodontist, after adequate diagnosis based on case history, models, photographs and roentgenograms.

Environmental and etiologic influences and other factors are so intimately connected with correction and retention as to necessitate their receiving consideration in all cases. If these factors are ignored, mechanics are of questionable value. Mechanical therapy must be compatible with the biologic factors. If we all had, by education and from experience and practice, the proper biologic concept of orthodontia, serious consideration of my subject would be unnecessary, because the question raised would be satisfactorily answered before we started.

We must realize that many men do look too casually into orthodontia, both in theory and in practice. Orthodontia is not merely a matter of appliances. Certainly any given case needing orthodontic therapy can be treated by any one of several methods and by means of any one of innumerable appliances. No case can be adequately handled by appliances without knowledge, experience and intelligent interpretation of the many biologic factors in the case.

A child in need of orthodontic treatment is a sick child. Any thought of appliances alone without consideration of the child as a whole would imply the treating of but a single symptom, and failure to consider the whole picture, which is so necessary to the successful practice.

First, what is orthodontia? McCoy well defines it as "a study of dental and oral development . . . to determine the factors which control the growth processes to the end that normal functional and anatomic relationship may be realized, and . . . to learn the influences necessary to maintain such conditions when they are once established." There is not one word about appliances in this or in any other adequate definition.

Would stock appliances or those constructed especially for the case best fit in with this conception of our field? No answer would be reasonable but that each case should receive such adequate diagnosis as to demand that an appliance be especially constructed to fill all the individual needs of the case, and so handled as to meet environmental influences and to fit the patient's own functional individuality. This means that a careful study of the case history must be made before the malocclusion itself

can be considered from a treatment standpoint. Frequently, the study of the child is of more value than study of the models. It may bring into the picture anything from endocrine imbalance to unfavorable environment, either of which would contraindicate success in treatment unless eliminated.

The corrective appliance itself should naturally be designed to fit the individual need of the case at hand. In planning it, definite questions have to be considered seriously: Should the case be treated at all? If so, when and in how many of the several dimensions should the teeth be moved in relation to the cranium? Should all or some of the teeth be moved? Should they be moved bodily or tipped or should only a delicate pressure be applied and in such a way as to stimulate the developmental processes of the child? Should the appliance be fixed or removable? Should the Angle ribbon or edgewise arch be used? Should a plain arch or one used in connection with the McCoy open tube or the Ketcham hook be considered? Should lingual arches be employed? If so, what type? Soldered to molar band or removable, with round or oval soldered anchor post? And, in this case, how should we lock the appliance? Or should the one piece lingual arch with the torque lock be used? These and other types of appliances may be considered. When the choice is made, the practitioner must decide how frequently the appliance shall be adjusted, and how much pressure shall be applied. There is also the question as to whether the pressure should be continuous or intermittent. When intermittent, how long should the rest periods be? Is the tissue tolerance normal or limited? Again, when the technic is determined and the appliance placed, the question must be answered, as to whether the tissues will take up the mechanical stimulus as applied by the appliance and interpret it in actual developmental change. If so, with what speed? To what extent is the patient a good orthodontic subject from this standpoint?

How can all these problems and others be best solved—by using a stock appliance or by using one especially constructed for the case by an experienced orthodontist? I know your answer, but even the specialist knows too little of his problems. He has solved many of those problems and discovered diagnostic principles adequate to bring orthodontic practice out of that chaos of experimentation and invention of thirty years ago, progress which is indeed gratifying, but there are still so many unsolved problems facing us that we feel humbled, even though stimulated and intrigued by the thought of the future that must be so full of promise, if thoughtfully and honestly approached by the young men of today and tomorrow, who must carry on the research so necessary for true progress. Valuable as is research, it must be coupled with or built upon experience, so that the mind will subtly marshal this experience into new combinations and gradually such experience will "click" with the new idea and thus produce the new way of solving a problem.

We are told by Mershon and Johnson that we can move teeth anywhere, but can hold them only when they are in conformity with function, and with the patient's individual normal. This emphasizes the importance of the environmental phase of orthodontia, which has been accepted by orthodontists, and brings out Wolf's law, which states that modification of structure in the living individual conforms with the manner of

use. This law has long been accepted by the medical profession. We should make use of mechanical orthodontic appliances only in accordance with nature's laws of growth and development.

Howard goes so far as to say, "The theory that bone will grow under the influence of mechanical stimulation and that bone growth can be initiated by mechanical pressure alone has no place in the proper conception of our work." He further states that "mechanical stimuli are subservient to inherent growth impulses and their application should be simultaneous with periods of growth," and that we should know through statistical investigation "the best psychologic age in which to assist nature in treatment." He states also that there are "certain types of growth cases on which mechanical stimuli have little or no effect," "and that there certainly are periods of growth and nongrowth and a propitious period for the application of appliances in accord with these growth cycles."

Hellman calls our attention to "the very complex nature of development as it concerns the human face; the efficiency with which this development has been attended to for hundreds of thousands of years without the aid of orthodontic appliances; the great care necessary to determine just when these natural phenomena are in need of assistance; and the risk of attempting to do something with orthodontic appliances that might be accomplished in the course of time by natural development." The decision as to which cases will improve without treatment and which will not is not to be arrived at casually.

Marshall, of California, has lately shown by experiment that monkeys fed faulty diet show root absorption and do not respond to orthodontic treatment, while those on a normal diet show no such condition, and respond satisfactorily to orthodontic stimulation.

If these deductions are correct, there are more cases with poor orthodontic prognosis than we have realized. This new thought will broaden our therapy and place it more intimately in contact with the work of the pediatrician, or emphasize that, to understand our problem, the orthodontist should be first a pediatrician.

As our problems become more complicated, I ask again which is more advantageous for treatment, the stock appliance or one especially made for the case after a consideration of the individual patient?

Dentists and orthodontists, by the very nature of their restorative and corrective work, are, in all probability, dealing too generally with materials and appliances as related to the largely mental field of prescribing and giving advice and counsel. After all, the things called appliances that we use in our work are only the relatively unimportant tools in an intricate process of therapy. Those who know little and care less about the biologic nature of this process are those who think and work in terms of appliances only. That is what I should call mechanistic orthodontia. The practice of using mail order appliances, made by laboratories whose service presumes to include advice, is particularly empiric and mechanistic. In the opinion of the well informed, much damage can be done by the inadvised use of this armamentarium. No adequate diagnosis can be made through the mail. Even if it were made, the clinical experience and orthodontic judgment are lacking to interpret the findings. That the volume of such appliances used is large is not because there is value in this attempt to treat

malocclusion. It is but a tribute to the power of modern advertising.

Advertising, by speaking to thousands, usually gets action from a few. It makes the individual conscious, by beautiful word pictures, of new products that are frequently beyond his reach, both financially and mentally. A prominent advertising man says, "So far as advertising goes, we are fallen on evil days. Even a brief excursion through the average newspaper or magazine is for the advertising man who respects his calling a disheartening experience. True, much of the advertising is good, but much of it is bad. The public does not discriminate."

The treatment of disease by mail and the advertising relative thereto is fast disappearing, for such advertising is not acceptable to our best periodicals and newspapers. Our own attitude and that of the dental trade should be equally high minded as regards the same problems in our profession, the treatment of malocclusion by mail by laboratories. Actually, methods of treatment are sold under the guise of appliances.

Another consideration, and what to me is more important than any other feature of the interpretation of all our knowledge as applied to diagnosis and treatment and how to use it to best serve the interests of our little patients, is what I will term orthodontic conscience or judgment. This last argument will close my plea for especially constructed appliances to best answer the demands of orthodontic treatment. As Miller[1] has well said, craftsmanship and even knowledge of facts are of small value unless interpreted by judgment. Surgeons term this surgical judgment: we would in this case say orthodontic judgment. Orthodontic judgment may seem to be almost intuition, but it is more than that, for it is based upon experience, which is the translation of what we and others have seen and done and thought, and also profit gained from our mistakes and those mistakes observed in others. Out of all this comes to the honest man an orthodontic conscience which dictates what he can or cannot do. We so recognize the orthodontic and personal limitations which are present in many cases. This quality in a man will make him call for assistance from his confrères more frequently, or frankly state the inadvisability of treatment. Honesty and sincerity of purpose are certainly more important than matters of technic. The man of true orthodontic conscience, possessing safe judgment, will apply sound principles in thinking his cases through before getting far beyond his depth. His responsibility is indeed a serious one, not to be taken inadvisedly. The future happiness of many children, in relation to their health and appearance, is definitely his obligation—an obligation which no honest man will take lightly.

Important as is an appliance in successful treatment, more important still is this orthodontic judgment and experience of the men behind the appliance. The correct selection, construction and use of the appliance in a given case is the determining factor, not the appliance itself. Appliances may, of course, be constructed to advantage by the practitioner, or under his direction, of machine made parts such as wire, band material, tubes, arches, and brackets, to interpret his diagnosis. It must be realized that the appliance itself has not inherent ability. It cannot be purchased as a complete unit or stock appliance, like a car. The orthodontic appliance functions efficiently only as it interprets the knowledge, experience and judgment of the mind that directs it —no more and no less.

1. Miller, C. J.: Am. J. Surg., 13:325 (Aug.) 1931.

SOME EVERY-DAY PROBLEMS IN CHILDREN'S DENTISTRY*

By GEORGE E. MORGAN, D.D.S., Milwaukee, Wisc.

WHEN we realize that dentistry in the United States has almost reached its century mark, we wonder why children's dentistry has played so small a part. Is it because of lack of interest in the future health of our children, or is it because our dental schools have been slow in adopting pedodontia as a part of the dental curriculum? What did we learn about children's dentistry when we went to school? Dentists of the past have not been taught the fundamental principles in the proper care of children's teeth. Working for children is quite different from working for adults and requires special thought and study.

Fig. 1.—Premature loss of deciduous molar.

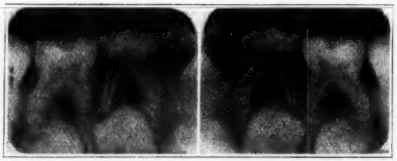

Fig. 2.—Caries in proximal surface of deciduous molars.

No one will deny the fact that true prevention must begin with the child. In our every-day problems with children, we are often confronted with the condition shown in Figure 1, a condition easily prevented and yet sometimes quite difficult to correct.

Premature loss of deciduous teeth, the most common cause of malocclusion, is primarily due to decay which has progressed to such an extent that the deciduous tooth cannot be restored to health and function. Because of the broad contact of the deciduous molars, many times it is quite difficult to detect small proximal cavities. The roentgenogram is very valuable in the detection of small cavities, as shown in Figure 2, and is sometimes the only means of recognizing decay when it first occurs on these surfaces.

I believe that more failures occur in cavity preparation and the selection of filling materials for these proximal cavities than in any other phase of operative dentistry for children. In the preparation and filling of these cavities, one must bear in mind certain anatomic characteristics of the deciduous teeth, together with normal growth and development.

In making a comparative study in

*Read before the Section on Mouth Hygiene and Preventive Dentistry at the Seventy-Fourth Annual Session of the American Dental Association, Buffalo, N. Y., Sept. 13, 1932.

Figure 3, of a child 3 years old, we note that the first bicuspid is developing in advance of the second bicuspid. Therefore, the first bicuspid, if eruption is normal, will erupt before the second bicuspid. In other words, the distal portion of the first bicuspid will, when the child is a few years older, be in contact with the mesial portion of the second deciduous molar, as shown in Figure 4.

This fact has a very important and direct bearing on the filling of proximal cavities in the deciduous molars.

When the cavities are small, as in Figure 2, they may be prepared and

Fig. 3.—Case in 3-year-old child in which first bicuspid is developing in advance of second bicuspid. Under normal conditions, the distal portion of the first bicuspid will later be in contact with the mesial portion of the second deciduous molar.

filled in the following manner; first, by preparing the first deciduous molar for a compound distoclusal cavity, as shown in Figure 5, left.

This will permit access to the mesial surface of the second deciduous molar, which may then be prepared as a simple proximal cavity, as in Figure 5, right.

I believe that copper amalgam is the best filling material available for this simple proximal cavity in the second deciduous molar, as shown in Figure 6, left; first, because it is away from the stress of mastication and, secondly, because the margins will not be in a self-cleansing area. The deposit of copper salts will prevent recurrence of decay. The steps shown in Figures 5 and 6, left, can be accomplished in one visit for the average child in not more than thirty minutes.

At the next visit, the temporary filling previously placed in the first deciduous molar is removed and the copper amalgam filling polished. The compound filling is

Fig. 4.—First bicuspid erupted in contact with the mesial portion of second deciduous molar (normal eruption).

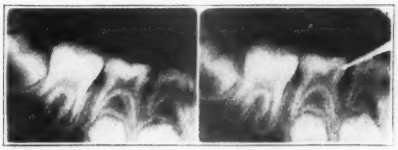

Fig. 5.—Left: Preparation of first deciduous molar for compound distoclusal cavity, permitting access to mesial surface of second deciduous molar, which may then be prepared as simple proximal cavity (right).

then placed in the first deciduous molar. In the selection of the filling material for this cavity, I recommend only two: silver amalgam or a gold inlay. For the average child, silver amalgam will serve the purpose well. If the operator has a case in a very young child or in which the minimum amount of preparation is indicated, together with the maximum amount of durability, the gold inlay should take preference over the silver amalgam.

Figure 6, center, shows copper amalgam in the mesial portion of the second deciduous molar and silver amalgam in the distoclusal portion of the first deciduous molar. A matrix should always be used in placing silver amalgam in compound cavities.

If these proximal cavities are larger, it is necessary to make both of them compound fillings, as shown in Figure 6, right.

Both of these cavities may be filled with silver amalgam. The cavity in the second deciduous molar should always be filled first and polished well before the filling is inserted in the first deciduous molar, as we already know that the first bicuspid will erupt and be in contact with the second deciduous molar for a year or more. (Fig. 7.)

A smooth surface on the mesial aspect of the second deciduous molar will make the first bicuspid less susceptible to decay.

If the first deciduous molar is lost prematurely, a retaining appliance, as shown in Figure 8, above, may be used. This retainer is made by placing a gold inlay in the second deciduous molar. Added retention can be obtained by deepening the cavity in the occlusal surface. When the first bicuspid erupts, the appliance is severed at the inlay and the inlay left in place. The first deciduous molar, in most cases, is lost through neglect of caries. If this is the case, we may also expect to find caries in the second deciduous molar. I feel that this is the most practical way of restoring the second deciduous molar

Fig. 6.—Left: Copper amalgam in mesial aspect of second deciduous molar. Center: Copper amalgam in second deciduous molar and silver amalgam in first deciduous molar. Right: Both compound cavities in deciduous molars filled with silver amalgam.

Fig. 7.—First bicuspid in contact with filling in second deciduous molar for year or more (normal eruption).

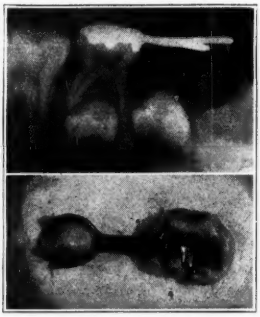

Fig. 8.—Above: Inlay type space retainer. Below: Occlusal view of inlay type retainer.

and at the same time retaining the space. Figure 8, below, shows an occlusal view of such a retainer.

When the second deciduous molar has been lost prematurely, malocclusion is certain to occur from the mesial drifting of the permanent molar, as shown in Figure 9, left. Figure 9, right, shows

Fig. 9.—Left: Case before treatment. Right: Case after treatment.

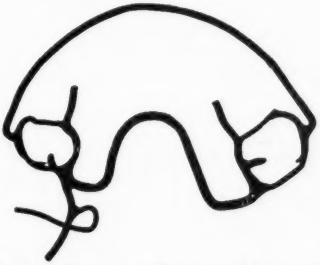

Fig. 10.—Crozat appliance used in treatment of case in Figure 9.

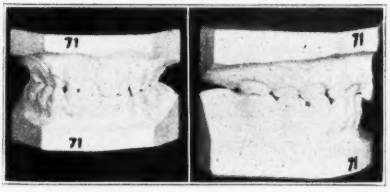

Fig. 11.—Model of child 3 years old showing neutroclusion with upper right central and lateral incisors, cuspid and first molar in linguoversion.

the same case after the first premanent molar has been moved distally to its normal position. This was accomplished with a Crozat removable appliance, as illustrated in Figure 10.

A band type of retaining appliance may then be used to retain the space until the eruption of the second bicuspid.

Many times, pedodontists, in their everyday problems with children, are

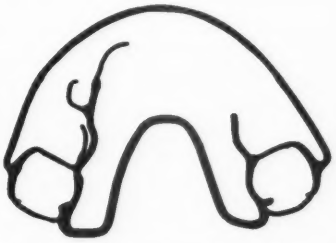

Fig. 12.—Crozat removable appliance used in treatment of case shown in Figure 11.

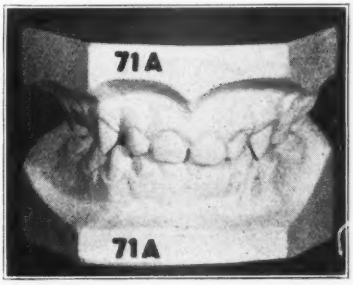

Fig. 13.—Case shown in Figure 11; after treatment.

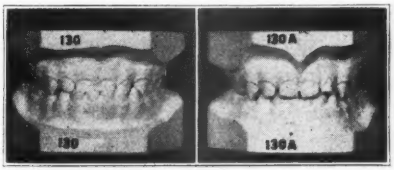

Fig. 14.—Case before and after treatment.

confronted with malocclusion of the deciduous teeth. I believe that a great deal of thought should be given to these cases of malocclusion. The two cases presented in this paper are typical of

the ones that should be corrected at an early age. If these conditions are not corrected at an early age, growth and development cannot be normal. Figure 11, the anterior and lateral views, is of models from a child 3 years old showing neutroclusion with the upper right central and lateral incisors, cuspid and first deciduous molar in linguoversion.

Figure 12 shows the Crozat removable appliance which was used in the treatment of the case. Figure 13 shows the same case after the teeth in linguoversion had been moved into their normal position.

Figure 14, left, shows models from a child 4 years old showing a tendency toward mesioclusion with linguoversion

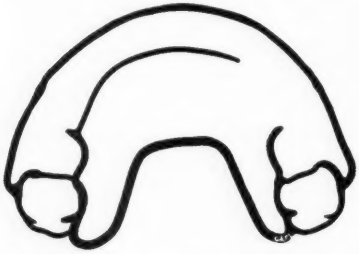

Fig. 15.—Crozat appliance used in treatment of case shown in Figure 14.

of the upper central and lateral incisors.

Figure 14, right, shows the upper central and lateral incisors moved to their normal position. In these cases, the tendency toward mesioclusion is usually checked after the upper anterior teeth have been moved labially. Growth and development are usually normal if the condition is corrected before the child is 5. Figure 15 shows the Crozat removable appliance which was used in the treatment of this case.

In our work for children, we must not lose sight of the fact that many deciduous teeth have no permanent successors. If this is recognized early and the deciduous teeth are properly cared for, they may remain in function throughout life. Figure 16 is from the case of a child 11 years old with congenital absence of the lower second bicuspids. The upper second bicuspids are slow in developing, perhaps for the same reason that these lower bicuspids are absent.

In Figure 17, from the case of a woman, aged 40, the second bicuspids

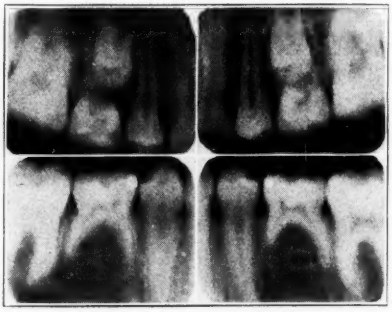

Fig. 16.—Congenital absence of lower second bicuspids.

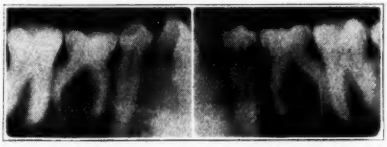

Fig. 17.—Congenital absence of second bicuspids in woman, aged 40.

are absent and the second deciduous molars are firmly in place with no signs of caries.

Operative procedures and the prevention and correction of malocclusion are of equal importance and should receive the same consideration in our work for children.

2039 North Prospect Avenue.

REACTIONS OF THE DENTIN TO ADVANCING CARIES*

By THEODORE B. BEUST, M.D., D.D.S., F.A.C.D., Louisville, Ky.

EVIDENCE of efforts at self-preservation are clearly exhibited by the reactions of a tooth to advancing caries. On examination, we find carious areas encapsuled by a layer of highly impervious dentin. This capsul is again enveloped by a zone of hyperactive tissue which, as I intend to demonstrate, is a reaction zone in which the dentin is undergoing a change from an active permeable state to the impermeable form first mentioned. A study of these zones clearly indicates that the dentin is alive and reacting. Caries being the commonest form of irritation affecting the teeth of civilized man, its effects appear preeminently adapted for investigation of biologic changes occurring in the calcified tissues of the teeth.

Reaction to incipient caries of the enamel has been considered by Mummery,[1] who demonstrated zones of resistance around the points attacked. Among the changes appearing in the dentin when a tooth is invaded by caries is the development of zones of transparency. These have long engaged the attention of observers. Many explanations have been given regarding their origin. Of these, the most credited are decalcification of the dentin by acids, the presence of fat in the tubules and impregnation of the tubules by calcified ground substance. After W. D. Miller's experimental work, which reached its culmination in his prize essay read before the Fourth Interna-

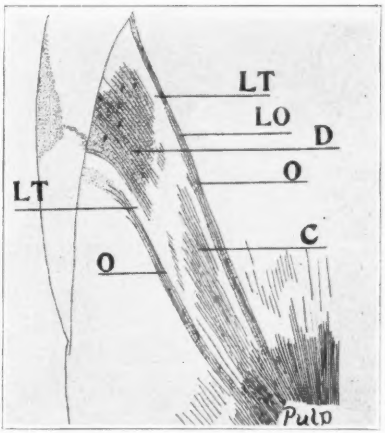

Fig. 1.—Diagram of area of caries seen in Figure 2. *LT*, lateral transparent zone; *O*, opaque zone; *LO*, opaque zone laterad from area of decay; *C*, central zone (dentin between decay area and pulp; *D*, decay (zone undergoing lysis).

*From the Research Laboratory of the School of Dentistry, University of Louisville.

*Work supported in part by a grant from the Research Commission of the American Dental Association.

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-Fourth Annual Session of the American Dental Association, Buffalo, N. Y., Sept. 14, 1932.

1. Mummery, J. H.: Brit. D. J., 47:473 (May 1) 1926.

tional Congress in 1904, the matter was, as far as I was able to perceive, ably explained by Miller's contention that the dentinal fibrils in such areas have become sclerosed and more resistant to acids.

Miller believed that the changes exhibited were the result of vital reactions occurring in the dentin. A number of observers opposed this view. Twenty-five years later, E. W. Fish[2] published an investigation which attracted much attention both here and abroad. This contribu-

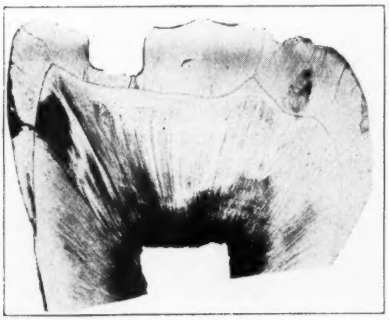

Fig. 2.—Carious areas diagrammed in Figure 1. Tubules of the lateral opaque zones are seen to end in sound enamel.

Fig. 4.—Beginning caries in fissure of molar.

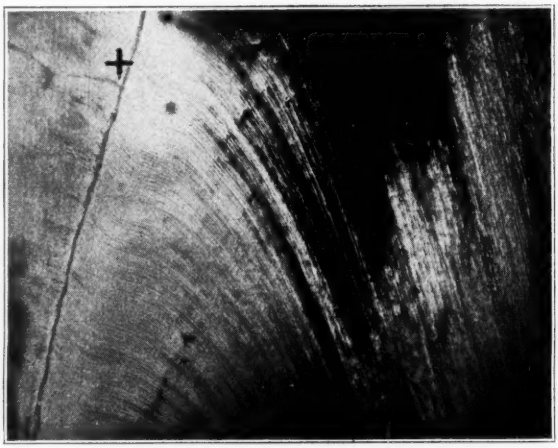

Fig. 3.—Magnification of ends of tubules composing the lower lateral opaque zone of Figure 2. The tubules end in sound enamel at *X*.

2. Fish, E. W.: Brit. D. J., 49:593 (June 1) 1928; Lesions of Dentin and Their Significance in Production of Dental Caries, J.A.D.A., 17:992 (June) 1930.

tion purportedly showed that dentinal fibrils affected by the caries attack, instead of becoming sclerosed as contended by Miller, died down to the pulp and became permeable to external agents; also, that the zones of transparency were not common concomitants of caries. In 1930, I presented a discussion[3] based on experimental evidence and opposing these views. Entirely new methods, involving intensive staining processes, were introduced (technic[4]). By these methods, it was established, as shown in that and succeeding contributions, that the common opaque and transparent areas found in nearly all sections cut from intact adult teeth were, in all respects, similar to the impermeable zones found under caries. It was furthermore brought forth that irritations, such as decay, abrasion, erosion and pyorrhea, educed physiologic responses on the part of the pulp which hastened the formation of this modified tissue in relatively young teeth. In these papers, the mechanism of formation of the opaque and transparent zones was described under the caption "tooth-maturation,"[5] and the relation of this tissue to caries resistance was discussed.[6]

This introduction provides a background for the following report, in which attention is called to heretofore unknown phenomena attending the development of the transparent zone under carious areas. It will be seen that the dentin is alive and reacting and that a conversion of opaque into transparent dentin, which has heretofore been questioned, occurs. The phenomena to be considered also permit of further far-reaching deductions, for we are now enabled to approach the question of the occurrence of catabolism

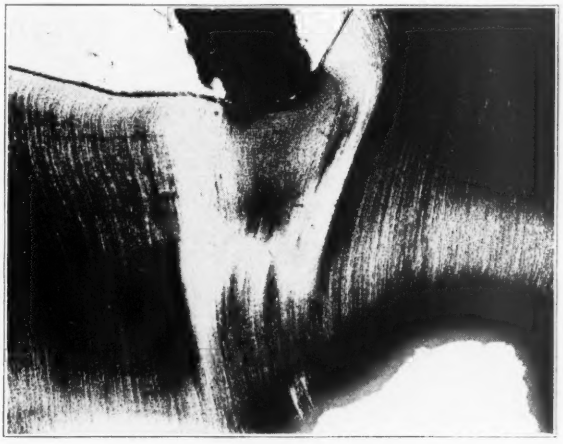

Fig. 5.—Enlargement of area from Figure 4 showing termination of tubules of hyperchromophilic lateral opaque zones in sound enamel.

3. Beust, T. B.: Reactions of Dentinal Fibril to External Irritation, J.A.D.A., 18:1060 (June) 1931.

4. Beust, T. B.: J. D. Res., 11:267 (April) 1931.

5. Beust, T. B.: Posteruptive Changes in Maturation of Teeth, J. A. D. A., 18:2186 (Nov.) 1931. D. Cosmos, 74:541 (June) 1932.

6. Beust, T. B.: J. D. Res., 11:619 (Aug.) 1931.

in the calcified tooth tissues from an entirely new perspective.

In order to convey my ideas, I have prepared a drawing representing one of the carious teeth studied. (Fig. 1.) Here we find three areas of modified dentin. First, we see a diffusely stained area, *D* (decalcified), representing that part of the zone of decay which has already undergone partial lysis. Surrounding this, we note the clear capsul of impermeable tissue which forms the transparent zone. Assuming with Miller that the tubules of this area are sclerosed, we will regard it as sclerosed transparent dentin. Around this clear area, we find another modification of dentin, corres-

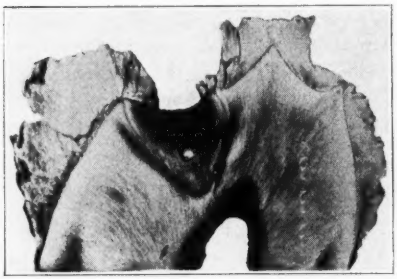

Fig. 6.—Decay with pronounced zones. The spot under area *D* is an artefact.

Fig. 8.—Cross-section of filled molar with three defects exhibiting extensive lateral transparent zones.

Fig. 7.—Multiple caries. On the left, undermining caries has obliterated part of zone *LT*. To the right, zone *LO* is missing, its formation being unnecessary as the sclerosed part of the tooth adjoins the caries area.

ponding in position to the opaque fibrils bordering decay seen by Miller. This we will call the opaque zone (*O*). For our purpose, we will subdivide these zones into three regions, the one lying between the decay and the pulp being the central zone, *C*, the region bounding the decay laterally being the lateral transparent zone, *LT*. The opaque tissue adjoining the lateral part of the transparent zone, we will term the lateral opaque zone, *LO*. Discussion will be limited mainly to these lateral regions.

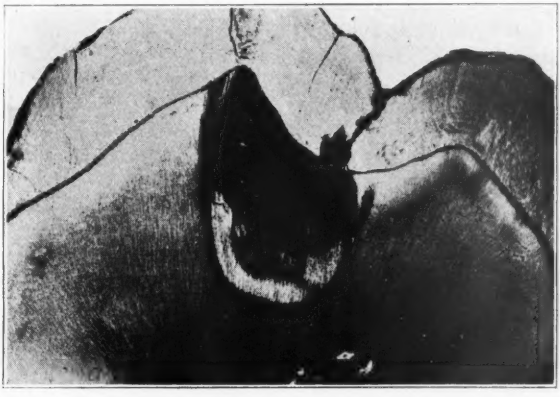

Fig. 9.—Caries with apparently partly obliterated lateral transparent zones. (Compare Figures 10-11.)

TRANSPARENT DENTIN

Attention is first called to the transparent zone. Under "transparent," we visualize a modified dentin the tubules of which have been rendered more or less invisible. This dentin is rarely free from numerous opaque tubules. The term signifies simply that the dentin falling under this heading is relatively transparent. We find, moreover, that this tissue, when subjected to the intensive staining methods referred to above, is further differentiated from normal dentin through its imperviousness, as exhibited by its stain-resisting or chromophobic behavior. This was adequately proved by me elsewhere.

With the exception of the external point of entrance of the caries, the zones of transparency usually completely surround all of the dentin attacked. This statement is at variance with the view of W. D. Miller, who contends that, as a rule, the transparent zone is wanting on the lateral margins. The formation of a lateral zone is of significance to us as its common presence in this region would involve parts of tubules which lie at a great distance from the pulp, yet which can be affected only indirectly by the carious process. It is obvious that changes in parts completely segregated from the caries must represent reactions reflected from distant tubules which were directly irritated by the carious process. Take, for example, the outer layers of the impervious zone *LT*, Figure 1. The tubules and the lateral communications contained in it, as experiment has shown, are completely calcified and thereby removed from the influence of the carious process.

Another and far more significant illus-

tration is seen in the Figure 1 *LO* zone. Here, the tubules can be affected through the pulp only, as an examination shows that its tubules end in sound enamel, excluding the influence of external agents. This region must be modified by impulses reflected from the fibrils in zone *C* by the pulp. These fibrils (*C*) are not, as has been contended by Fish and others, primarily occluded by deposits of secondary dentin, but are, in the stages here shown, always open.

To further emphasize these statements, the specimen from which the drawing in Figure 2 was made is presented. It is

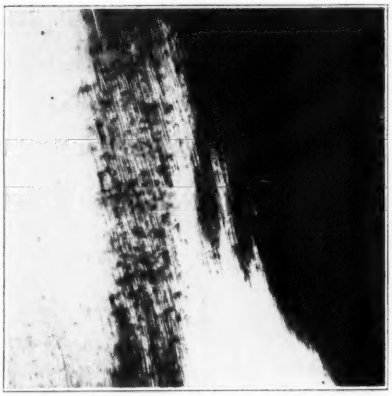

Fig. 10.—Differentiation of left side of obliterated part of zone *LT* seen in Figure 9.

here evident that the tubules of the zones *LO* end in sound enamel; which shows that they could not have been affected by external agencies, but only reflexly, as already explained. Figure 3 also shows the isolation of the zone *LO*, its fibrils ending at a great distance from the point of attack.

OPAQUE DENTIN

Ordinarily, opaque dentin possesses some of the qualities of the transparent form in that its tubules are generally obliterated and impervious. It also shares the properties of the transparent tissue in being relatively resistant to mechanical and chemical agents and to impregnation by dyes. In the case of the opaque zones of active caries, a remarkable differentiation can be made, the zones here exhibiting, to my surprise, a permeability in excess of that ordinarily present in the dentin of the affected tooth. Changes of this nature must, as has been implied, receive their stimulus from the dental pulp.

COMMENT

Figures 4 and 8 adequately demonstrate the occurrence of the lateral transparent zones. Practically all of my stained specimens show these zones definitely. One showing the apparent absence of a well developed transparent zone is shown in Figure 9. Miller's observation of unstained and of carmine and eosin stained specimens did not permit of the differentiation attainable with the intensive fuchsin method. The areas to the left and right of the areas of decay (Fig. 9) may be regarded, when superficially examined, as displaying an absence of the lateral transparent zone. When examined under higher magnification (Fig. 10-11), the zones are easily differentiated, the slight coloration between the lateral opaque and decalcified zone being caused either by the too rapid extension of caries or by the fact that the process of conversion is not yet complete.

A cavity once developed, barring exceptions, increases in size despite the resistance offered by the tooth. The extension of the area affected is accompanied by the extension of zones *LO* and *LT*. As the extension of the decay is preceded by the extension of these zones, new areas of dentin are necessarily involved. We may therefore logically conclude that a continuous conversion of the normal into the hyperpermeable opaque and the

opaque into the chromophobic transparent form occurs.

The views expressed in this paper gain added support from the observation that abraded teeth also exhibit the lateral reaction zones (Fig. 12). These are less marked than in caries as here the progress of the irritation is less rapid. The increased tingibility marking the zones *LO* is seen to keep pace with the lateral exsion of the abrasion. The transparent zones formed in these cases, while clearly differentiable, are often intermingled with opaque fibrils; which shows that the hyper-active chromophilic opaque tissue may be converted either into the chromophobic opaque or chromophobic transparent dentin. The hyperchromophilic fibrils therefore appear to be the precursors of both of these modifications of the dentin. The assertion that bony structure is in a continuous state of flux appears to apply

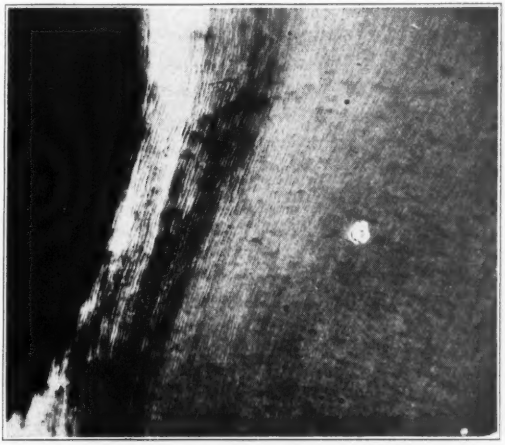

Fig. 11.—Differentiation of right side of obliterated part of zone *LT* seen in Figure 9.

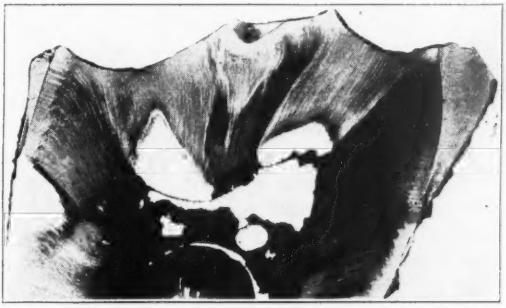

Fig. 12.—Abraded molar; semitransparent dentin under abrasions bordered by zones *LT* and *LO*.

with equal exactness to the dentin of teeth with active pulps.

The increased colorability common to the zone *LO* must result from local changes caused by conditions suggestive of the increased activity found to occur adjacent to a focus of irritation in other tissues, this being in fact an inflammatory zone. During the transition from the normal to the transparent, the calcified dentin ground substance appears to undergo molecular rearrangement, its marked permeability in this state not being a property of the dentin matrix of the adult tooth.

The changes described in this paper class the dentin, as far as vitality is concerned, with any other connective tissue. The further inference is also permissible that a withdrawal of inorganic salts from the dentin in catabolism could, in the presence of a live pulp, occur in large areas in a similar manner, because an activity possible in a limited zone can conceivably become general. When total permeation of the dentin of adult teeth can be attained by staining, we can now conclude that withdrawal of inorganic material may have occurred.

SUMMARY

A carious area in the dentin of vital teeth is surrounded by two cylinders of modified tissue, the inner composing the long known impervious transparent zone, the outer consisting of an inflammatory area in which molecular rearrangement conducive to the protection of the tooth is occurring.

UNDER WHAT CONDITIONS SHOULD A GENERAL PRACTITIONER INCLUDE ORTHODONTIA IN HIS PRACTICE?*

By HAROLD M. CLAPP, D.D.S., Utica, N.Y.

IT seems that in part the answer to the question "Under what conditions should a general practitioner include orthodontia in his practice?" can be found in the dental college. I do not desire to go into the details of the teaching of orthodontia in the dental college. It has been debated until we all feel that we are familiar with its virtues and its shortcomings. I have neither commendation nor censure to offer at this time, but it is my opinion that the average graduate is not capable of treating orthodontic cases properly. There is in every class some student or students who have decided to make orthodontia a part of their practice, or perhaps specialize in it. Such men pay particular attention to instruction in the subject and receive extra training from the instructors in this branch, and they are no doubt equipped to proceed cautiously with the treatment of cases; and, over a period of years, if they are alert, learning from their own experience, and striving earnestly to improve their technic and theory by reading and lectures, and by observation at clinics, etc., they may become proficient in

*Read before the Section on Orthodontia at the Seventy-Fourth Annual Session of the American Dental Association, Buffalo, N. Y., Sept. 14, 1932.

the art, and the results of their treatment, in many cases, be extremely creditable.

To my mind, this is the ideal way to specialize. In other words, I believe a certain period of general practice is a proper foundation for a specialty, and I do not agree with those who vision dentistry and orthodontia as two separate sciences, taught separately. I feel that enough of the great underlying principles of dentistry could not be taught in an orthodontia college to make the best orthodontist. To be a well-rounded orthodontist, one should have the lessons regarding the cause and effect of the laws of dentistry impressed unforgettably by practice. The practice of orthodontia is so difficult, so involved, so dependent on the forces and influence not generally under consideration of the general practitioner that to gain the knowledge to excel in it may easily tax one's entire time and energy.

I have had a long and interesting experience in general dentistry and with general practitioners. I have made it a rule to ask the dentist referring a case, "What is it like? Is it a hard case or an easy one?" It is surprising, after seeing the case, how accurately we can judge a dentist's knowledge of orthodontia by his answer to this simple query, and it is on these contacts that I base my conclusion that the "average dentist" is not capable of treating orthodontic cases. Then the question arises, should not the general practitioner treat simple cases? No doubt he should, but the "average dentist" cannot diagnose an orthodontia case; so how is he to choose the simple cases?

I am referring more or less frequently to the "average dentist," but please do not interpret this to mean that I hold those noble men, "the average dentists," who are the honor-guard in our profession, in small esteem. Indeed, I honor them, and I have many times been impressed by the very accurate knowledge of orthodontia held by general practitioners who never attempt the treatment of cases; but they are the exception, not the rule. Orthodontia has borrowed much from dentistry, and many of the most illuminating phases of orthodontia have originated in the mind of the general practitioner.

A dentist who extracts a first bicuspid without due consideration, to permit a cuspid to erupt, may be qualifying as an exodontist, but not as an orthodontist. I recall one such case in which two maxillary first bicuspids were extracted and, in about a year, the cuspids were in nice alinement, but the maxillary six anterior teeth were in lingual occlusion, and a Class 1 case looked like a very bad Class 3. And this dentist told me he did not "look at the bite" before he extracted the teeth. I know that this incident is most unusual, and the "average dentist" could not be so crude. Another case was referred with the words "It simply needs to have the bite closed." That case proved to be the hardest open-bite case I ever attempted, and finally had to be discontinued, with only partial success, on account of root absorption.

What, then, do the majority of us, either orthodontist or general practitioner, know of the phenomena of root absorption? To which one of the theories do you subscribe?

It is incidents like the foregoing that, over a thirty-year period, compel me to make the statement that the "average dentist" cannot diagnose orthodontia cases; so how is he to treat the simple ones? But I feel that he should be able to do both. It is just as essential for a dentist to have a working knowledge of

the diagnosis of orthodontic cases as it is for an orthodontist to be able to recognize a Vincent's infection—or a cavity, if you please—in teeth under his care.

Again, monetary considerations should not compel the general practitioner to treat certain cases because he feels the patient cannot afford the specialist's fee. A dentist who serves his friend the cream and takes the skimmed milk himself is practicing an altruism entirely uncalled for. Likewise, an orthodontist who feels that he can receive from his fellow practitioner only those cases that can pay his regular fee is not very deeply imbued with the spirit of his high calling. As a matter of economic fact, the orthodontist, with his knowledge of what to do and how to do it, should be able to treat cases with less time and effort than the general practitioner, whose treatment is less efficiently directed.

Referring again to the matter of diagnosis: One of its most difficult phases is to tell when to start treatment, and even whether to treat or not to treat. It is not sufficient to say that this case is in such and such a class, and I will treat it so and so, at this age, because the textbooks on orthodontia say so. There are rules for diagnosis, but diagnosis is not a matter of rule: the makeup is too complex, too many factors are concerned in growth, for any man to set down hard and fast rules for diagnosis. It is a sense that comes after long and careful observation; it is, I might say, "a gift" that some may never have, and he who does possess it often cannot set down in words how he reaches his conclusions. It is hard for me to believe that there is any "exact science." It seems to me like the statement that "only a fool is positive of anything," the question "Are you sure of that?" and the reply, "I am positive." What we consider proved today may be disproved tomorrow. Nevertheless, "wise men say many foolish things and are still considered wise; likewise, fools say many wise things and are still considered fools."

Orthodontia is a part of dentistry and cannot, by any logical method of reasoning, be considered a branch of any other science. It is difficult to imagine anyone practicing orthodontia without a knowledge of the fundamentals of dentistry, and yet orthodontia is so closely linked with the problem of growth, with biology and heredity, that this child of dentistry seems almost to have found a foster parent. Surely, it must be common knowledge among orthodontists of experience that there are cases that must be watched, and let us remember that "he also serves who waits in readiness to serve." What about these cases that are kept under observation and allowed to develop? Do we not often find that they develop more toward the normal than the abnormal? I venture to say that many treated cases in which further treatment is unnecessary after the age of 10 would have had a satisfactory result without mechanical interference. I do not wish to be understood as advocating no treatment before this age in any case. Certainly some cases demand early treatment. What I wish to emphasize is that in certain cases of malocclusion, at an early age, it defies the most astute diagnostician to tell whether, in the ever-changing stages of growth and development, there may not be, at maturity, a normal result.

Possibly in these years between the ages of 8 and 16, some ductless gland hitherto performing indifferently produces its normal quota of secretion, and the whole picture is changed. Is it inconceivable?

A child on an unbalanced diet and

who bolts his food is placed on a correct diet and makes full use of all those various and complex factors that are involved in proper mastication, and we see a case of malocclusion being corrected before our eyes, by function. A change to normal breathing or correction of other bad habits produces profound changes for the better that orthodontic appliances never could effect.

When, then, should a general practitioner treat orthodontic cases? My answer is: Only when he can understand and classify cases, and has a knowledge of what is taking place in the tissues from his appliances; in other words, after he is prepared. He plays a most important part in producing normal occlusion by giving preventive orthodontic treatment: (1) by keeping the deciduous teeth in repair that they may perform their full duty in mastication, (2) in removing them at the proper time, lest their permanent successors become deflected, (3) by inserting space retainers where indicated when teeth are prematurely lost, and (4) by making his restorations true to tooth form. All of these are done by the "average dentist"; they are invaluable in preventive treatment.

The general practitioner should resort to orthodontic appliances to correct abnormal positions of the teeth; but before one can proceed to correct an abnormal condition, the normal must be known. One must know where he is going and which road to take if he wishes to arrive at his destination. Therefore, if we are traveling and in doubt as to which road to take, we ask someone, presumably someone who knows. I make a plea for a closer relation of dentist and orthodontist. Unnumbered cases of malocclusion are today untreated. If they were all to be presented to the now existing specialists for treatment, it is too evident that only a small percentage could be given treatment. Who, then, is to render service to the remaining great bulk of child humanity suffering from malocclusion? Or is the dental profession to permit these children to go through life thus handicapped?

Here, then, is a challenge to the dental profession—to general practitioner and orthodontist alike. The president of the University of Wisconsin made the rather startling statement that "the measure of a man is the measure of the challenge he hears—*and accepts.*" The dental profession is challenged today for its inability to place the benefits of its administrations within the reach of all, not alone in orthodontia, but in the other branches as well. Perhaps many dentists do not know the need and do not hear the challenge, but the average dentist and the expert does. They are the majority of the profession: do they accept the challenge?

It is my belief that the general practitioner should possess a knowledge of orthodontia, especially of diagnosis and, possessing it, should treat the less complicated cases. If he is in doubt, he should consult the specialist in a truly professional spirit, and he will, I know, be met in the same manner. The general practitioner of medicine does not attempt the removal of a cataract from the eye, but, by his fine judgment, he does diagnose and treat many minor ailments of that delicate organ, to his own credit, and thus leaves the specialist free to perfect and employ his skill in the more difficult operations. This, then, is the view I take of the orthodontic problem.

A poet once sung:

The sword is a weapon to conquer fields
And I honor the man who shakes it;
But what is the man who the broad sword wields,
Compared to the man who makes it?

In my opinion, the poet was wrong: any instrument made to inflict itself on a human being depends for its effectiveness much more on the skill of him who uses it than on that of him who makes it.

So, lest I be misunderstood, I wish to say that I cannot too harshly condemn the dentist who, without proper mental preparedness, attempts the treatment of malocclusion because he thinks that there is magic in an appliance. Perhaps he is right; but maybe it is the wrong kind of magic. Also, I commend the dentist who, having prepared himself, strives earnestly to promote his patients' well-being by serving them faithfully in the field of orthodontia.

DISCUSSION

Herbert A. Pullen, Buffalo, N. Y.: I do not believe that a final answer to the question discussed by Dr. Clapp can be formulated at this time. It seems to be the general idea that the dentist can treat the simple cases, or, as Dr. Clapp expressed it, the less complicated ones, which I believe, more correctly designates them. With the possible exception of neutroclusion with a normal overbite, in cases presenting the full complement of teeth for the age of the patient, with a possible lingual position of one or more maxillary incisors and ample room for them in the arch, I have yet to find a simple case of malocclusion. If we assume that the undergraduate course in orthodontia has taught the student the biologic principles underlying orthodontic diagnosis, normal occlusion and classification and even something about gnathostatics and the use of a simple appliance, is it possible for the graduate student to differentiate between the simple and the complex cases that arise in his practice? Frequently, the orthodontist commences treatment on what he thinks is a simple case, only to find out that there are complications arising of which he was unaware. Even a rotated central incisor, crowded and in poor alinement, presents a complication in treatment which requires a change from a simple appliance to a complex one for its correction. In advising the dentist who attempts the treatment of simple cases to avoid cases of distoclusion and mesioclusion, the orthodontist is only advising the avoidance of cases which are difficult and ofttimes impossible of correction by the specialist because of a background of apparently hereditary or environmental defects. Orthodontia is really a study of the growth and development of the dental arches and surrounding tissues from the embryonic stage to birth and on to maturity, including a study of the effects of any abnormal conditions on the organism which might arise during this period. This is or should be the basis of teaching in the undergraduate courses in orthodontia. Classification and diagnosis under this heading assume their proper place, as well as the attempted differentiation between the simple and the complex case, so that the dental graduate, should he elect to treat simple cases, or practice preventive orthodontia such as was outlined by Dr. Clapp, will have the proper foundation. Less than 1 per cent of senior students in my classes are even interested in orthodontia, and it has to be given with a sugar pill to get them to swallow it. A postgraduate course in every school for such a small number would be entirely wrong. Again, every dental school cannot afford to give a postgraduate course in orthodontia and, in consequence, the elective orthodontia student is referred to schools which are endowed sufficiently to give a comprehensive course. Good dental care is the best preventive of malocclusion of certain kinds, and the four precepts stated by Dr. Clapp are valuable guides to follow. Dr. Mershon has well said that "the unseen things in orthodontia are more important than the seen," and the training of the student's power of observation in the undergraduate school is of great value. Much more might be said along these lines, and I trust that these discussions will be continued until we can answer the question even more to the satisfaction of the general practitioner than we have today.

CONDITIONS MAKING ORTHODONTIA UNSATISFACTORY IN COMBINATION WITH GENERAL PRACTICE*

By MORTIMER L. FAY, D.D.S., Buffalo, N.Y.

THAT phase of orthodontia which deals with conditions making inclusion of the specialty in general practice unsatisfactory possesses so many angles that it is difficult to deal with the subject without trespassing, more or less, on grounds that have been or will be covered by other essayists in this group. I can, therefore, but summarize the more important phases of this subject; in other words, the conditions most commonly encountered that tend to discourage the general practitioner who may be attempting orthodontic practice. In doing this, I must digress from my subject.

A great deal has been written, with much supplementary discussion, on the advisability of associating orthodontia with the general practice of dentistry. The urgent need of the general practitioner to include it in his practice is graphically portrayed in a statement made by William M. Stewart, director of the United States census bureau, to the effect that "twenty million, or 50 per cent, of the children in the United States under the age of 16 need orthodontic treatment." Of the 60,000 dentists in the United States, we find that only 800, or less than 1.5 per cent, practice orthodontia as a specialty. It seems that these two statements alone would establish its right to a place in general practice.

Modern orthodontia, roughly estimated, is about thirty years old; and we find, after thirty years of development, only 800 specialists practicing as such in the United States; which seems a small number in comparison with specialities that have been recognized as such only half of that time.

If we have 20,000,000 cases that need treatment now, can you comprehend what the number might be in the next thirty years if the same rate of increase prevails, and corrective measures are not inaugurated soon? We have, in this same thirty-year period, also seen the population of the United States increase 62 per cent, while the dental census shows an increase of 200 per cent. This rate of increase is not likely to prevail in the next thirty years. At the present time, the estimated number of general practitioners doing orthodontic work is 32 per cent, or about one in three. This percentage is not impressive, as it includes all who practice any orthodontia, which may mean one case a year or several.

As, from the foregoing picture, it is plainly to be seen that the 800 orthodontists cannot take care of this enormous number of children, it becomes not only desirable, but also imperative that the general practitioner include orthodontia in his practice; but, of course, with certain reservations, which means that he

*Read before the Section on Orthodontia at the Seventy-Fourth Annual Session of the American Dental Association, Buffalo, N. Y., Sept. 14, 1932.

must confine his practice to minor or preventive cases, all major or corrective cases being referred to the specialist, who is better equipped to take care of them intelligently. We cannot stress too strongly the importance of teaching the undergraduate to differentiate between minor and major cases, so that, in his later practice, he will exercise extreme care and caution in selecting his cases, limiting them strictly to those to be classified as minor. It is not always easy to differentiate between these classes, as the line of demarcation may be very fine; but it is better to err in favor of the minor case than to overstep the mark and become mired in the entanglements and complications which are sure to follow a disregard of this advice.

Granting that we can acknowledge a real need for the inclusion by the general practitioner of orthodontia in his service, we are naturally brought to the question as to why it is not more generally practiced and why it is often found unsatisfactory when it is attempted. There is one answer that can be summarized in two words: inadequate preparation. This primarily is why he finds his orthodontic practice unsatisfactory, just as he would find any of the other branches of dentistry if he had no more preparation in those subjects than he has in orthodontia.

The responsibility for this condition rests with our educators, and it should be their paramount concern to see that it is corrected. Orthodontia has never been allotted the time on the curriculums that its importance demands. The student is not sufficiently prepared to take up this work on graduation, as he is the other branches of dentistry. When, in the earlier stages of his practice, he attempts orthodontic work along with other branches of dentistry, he invariably comes up against this insurmountable obstacle of unpreparedness. He has nothing to fall back on, no retreat to make; in short, there is no escape from the predicament in which he finds himself; the net result being a dissatisfaction with himself, a tendency to become sour on the practice of orthodontia, to say nothing of the loss of prestige with his patient, if not the actual loss of clientele.

The replies to a questionnaire sent out, relative to preparedness, were almost unanimous in admitting this unpreparedness as the reason for not practicing orthodontia. At the same time, most of those replying expressed a desire to be able at least to take care of minor cases. This was especially so of those practicing in the smaller communities. Some cases were cited in their practice in which the need of orthodontic treatment was apparent, but the patient could not afford to go to a specialist, the carfare alone to and from the city making it prohibitive in most cases; yet the dentist freely admitted that he did not feel competent to undertake the case although while in college he had had a meager course, of which he now could make little or no use.

As a means of alleviating this condition somewhat, it was suggested in the questionnaire that an intensive postgraduate course be offered by our colleges, embracing six or eight weeks; or, alternatively, a week a month for six months. The postgraduate courses now being offered by our leading colleges are much to be preferred, and the foregoing suggestion was not offered as a substitute; but, unfortunately, there are but few who can absent themselves from their practice for a time sufficiently long to embrace these courses. I therefore made this suggestion, not with the idea of creating full-fledged orthodontists by any

means, but to give these men an up-to-date outline of the fundamentals as taught by the schools today. This idea was almost unanimously sanctioned in the answers to the questionnaire. Those who have been out of college only a few years have lost contact with the subject, for few general practitioners subscribe for or read an orthodontic journal, only about one in ten, I believe, the figures show. This course would furnish them the didactic and other necessary teaching, and would put them in a position to observe and better understand the ground work for preventive orthodontia; which necessitates the diagnosis, if possible, of underlying causes before beginning treatment of any condition in the mouth.

As I have previously stated, preventive orthodontia is as far as the general practitioner should venture in this branch, and this is the limitation previously referred to. He will find this field large enough and one of the most interesting in dentistry and the results most gratifying. If we had at our disposal some means of determining the percentage in this field of 20,000,000 cases, of the major and minor cases, we would find a very large majority in the minor classification.

A second and common excuse often offered as a reason for side stepping orthodontic practice is lack of time. Any excess consumption of time is due to the dentist's floundering around, with no definitely organized routine, trying to do all the work while the patient is in the chair. This can be corrected by the adoption of a proper technic, which must be developed to a point of perfection, making it a time, pain and labor saving operation, dovetailing into the office routine so that it will not conflict with other operations. The personal equation will, of course, play a prominent part in this, as in other work, as no two operators work alike. It will of necessity differ from the specialist's technic owing to the difference in the character of the two practices. With some thought and planning, it can be arranged that most of the work be done away from the chair. A technic has been worked out which fulfils this purpose and should be acceptable to most general practitioners.

Another phase of technic which we often find subjected to severe criticism is carelessness in taking impressions and making models. A good impression is imperative, an artistically carved model is not; but even a good impression and an artistic model can be made in a short space of time, and it should not be a long, tedious operation as done by most dentists. Two of the greatest timesaving devices given the profession of late, and which the general practitioner cannot afford to be without, are the ready made bands and assembled arches. These save much valuable time by eliminating trying features in construction. They pay for themselves in the time they save, not to mention the greater accuracy and refinement of the finished appliance. In mentioning these mechanical features, I do not wish you to infer that we should allow them to take precedence over etiology, diagnosis, intrinsic and extrinsic forces, or the possible part some of the endocrine glands may play in the growth and development of the jaws. I am purposely avoiding trespassing on these as well as the allied subjects related to orthodontia, as they will be dealt with by other essayists.

A third excuse which we frequently found offered was the inability to make orthodontia as remunerative as other branches of dentistry. Little need be

said in rebuttal to this argument. It is interrelated with the "time alibi." If the operator persists in a technic which consumes much unnecessary time, obviously this argument would be sound. On the other hand, the proper allocation of time in orthodontic practice will automatically net him as much per hour as other operations.

The outstanding obstacle encountered by the general practitioner is, I believe, their disinclination for children's dentistry. This is cited as the concluding point; and I feel in stating this premise that no contradiction will be heard. The subject is not hopeless, and even though it requires thought, and a knowledge of child psychology, it is of vital importance to us individually, as well as to the profession as a whole, that it be given the serious and whole hearted attention that its acknowledged importance warrants. It will, therefore, be my purpose to enlarge somewhat on this most vital, and what should be a very interesting, aspect of orthodontia.

Orthodontia is, in intent, 100 per cent confined to children's dentistry. The successful handling of children in the dental chair admittedly requires an utterly different psychology from that employed with adults. It matters not to the child what your reputation may be professionally. He is only interested in you personally; and his reactions will be entirely personal. On these reactions depends your success or failure, as no case can be carried to a successful conclusion without a reasonable degree of cooperation on the part of your small patient. Coercion by the parent is decidedly a hindrance rather than a help. It is imperative, therefore, that serious study be given the subject of child psychology as it relates to us and our patient.

The management of children is an art in itself. The subject could hardly be covered in a single essay. Of necessity, one has to build up his own technic; but there are general rules that apply in all cases. For instance; we should never try to force a child, but should go out of our way to humor him even though we have to make two or three appointments to do so. We should never be rough with or hurt him, always bearing in mind that the child has a memory, proverbially, as long as the elephant's; and we will never be able to overcome unfavorable impressions acquired in our early encounters. We should never try to work with the child through the parent, but appeal directly to him, securing his interest through an evidence on our part of an interest in him. Let us explore and discover his hobby, it may be anything from angleworms to airplanes; but a display of real interest in the child's hobby will gain his confidence as quickly as anything we might do.

Invariably, we immediately become intrenched in the child's confidence and trust, and we simultaneously attain, in like measure, the confidence of the parents. It then becomes easy to overcome prejudices which they themselves might have to orthodontia, due to the use of cumbersome appliances, which they may have worn in former years, and suffered torture in wearing. Likewise, it then becomes relatively simple to impress on the parents the importance of having the child's teeth examined, and watched for decay and manifestations of developing malocclusion.

The parents should be urged to bring the child in for periodic examination as early as the third or fourth year. The importance of these examinations can be stressed while we are doing work for the parents. Examples in their own mouths of deformity that might have

been avoided had they been fortunate enough to have had early advice and treatment will serve to make our statements much more impressive.

The condition of the child's mouth during the period of deciduous dentition and the transitional period which follows is most important, yet it is the period of greatest neglect; and, by this neglect, the jaws are thrown out of balance from the premature loss of one or more of the deciduous teeth or, through decay, the approximal surfaces lose their normal contact, the space reservation is encroached on, the normal functional occlusion of the teeth is seriously interrupted and the stimulus from mastication so necessary for the proper development of the jaws and related parts is lost to a large degree; a train of evils with which we are all familiar following.

Fortunately, these structures respond at this period to the slightest corrective touch, and many minor cases which would soon become major ones can be intercepted if we understand Nature's principles and the processes by which she works, and proceed to assist her at the proper time by artificial stimulus of the mildest sort. For, after all, we are only assistants: Nature does the real work, although we usually like to usurp the credit. We must remember that the bone with which we are dealing is a living, changing tissue, and not a homogeneous mass, and we should study closely Nature's method of growth and development, taking care not to embarrass her by overstimulating with too much pressure, which has been and still is a fault with too many operators.

CONCLUSION

It is not to be expected that we will find much to do in the mouths of the great majority of these young patients when we see them, perhaps, for the first time. However, special attention must be paid immediately to the subject of child psychology, and its relation to the parents, in order that we may fortify ourselves for the future.

While there will be conditions that will make orthodontic practice trying, as we occasionally find in other branches of our profession, we see no obstacles which cannot be overcome by the general practitioner.

It is to be remembered that the children of today are the fathers and mothers of tomorrow, and if we are to improve the race, they must have our best care and attention.

DISCUSSION

Walter H. Ellis, Buffalo, N. Y.: The relation of orthodontia to general practice has been discussed pro and con ever since orthodontia emerged from general practice, about thirty years ago. Most of the papers on the subject have been written by specialists, and it is enlightening to have this paper presented by a man particularly well qualified to speak from the standpoint of the general practitioner, because of his long experience both in general practice and in the treatment of orthodontic cases. His own experience in the combining of orthodontia and general practice has been successful, however, not because that is always a sound principle to follow, but because he is well-grounded in orthodontia, and could with good reason have specialized. I make no indictment of the few general practitioners of adequate training who thoughtfully diagnose and logically, conscientiously and successfully treat their orthodontic cases. Such men equal or surpass some who profess specialization; for it is not the name a man uses to designate himself but his results that count. I do indict the men who attempt to do that which they are not qualified to do and who, in this attempt, run the risk of doing irreparable damage. I am old-fashioned enough to want the general practitioner to know all and do all, but modern enough to realize that he cannot encompass the whole field. It is too broad for any one mind, and therefore specialization is both inevitable

and necessary. Dr. Fay gives statistics showing the small percentage of orthodontists in practice as compared to general practitioners. His figures are not so alarming as they sound because they cover rural as well as urban communities. The need and demand for orthodontic work is much less in the rural districts than in the cities. The appreciation of orthodontic service seems to bear a positive relation to the educational and cultural standing of the patient. In other words, the great mass of uneducated and poor do not demand orthodontic relief, and certainly do not appreciate it in any degree proportionate to the work involved in treatment. I speak from experience. On the other hand, the educated, cultural patient demands orthodontic care and expresses an appreciation of results that is indeed gratifying. At the present time, the orthodontist is established in the urban communities in the proportion of one to each 100,000 of the population, which seems to be about the percentage of appreciation accorded the specialist now. The law of supply and demand is such that just as soon as more specialists are needed, they will materialize. I do not wish to infer from this that orthodontic treatment is not of great importance to the under privileged child from a health standpoint. I am speaking only from the statistical standpoint of demand as related to the orthodontic service available. Actually, I believe that the public service relation of orthodontia and our obligation to humanity, and the problem of the child in its broad sense, should be considered seriously by both the specialist and the general practitioner. It is a vital factor in public health, and orthodontic treatment should be available to the poor to a larger extent than it is at present through college and hospital clinics and infirmaries. Dr. Fay's observations relative to child management and dentistry for children during the period of deciduous dentition and the transitory period are sound and the underlying principles should be more generally accepted by general practitioners. Dr. Fay suggests that the general practitioner limit himself to minor cases, but when we study these cases, we find few that are really minor cases. The more we know about orthodontia, the fewer really easy cases we find. The man who can treat what seems to be an easy case can also treat the more complicated one. In my opinion, the best colleges give courses in orthodontia even though they do not produce specialists that equal or surpass in interest and enthusiasm the "run of the mine" student in this branch. Those with an inclination toward and a natural bent for orthodontia can get much more instruction from teachers of orthodontia than is usually the case, and can graduate with a workable knowledge of the subject. I will admit that there is a demand for intensive orthodontic instruction for the men who some years after graduation find a real need for further study. This situation could be handled by the college through postgraduate courses. Those affiliated with state universities that are supported by state funds should be the first ones to encourage this instruction and to show the public the intelligent use of its funds. The societies and study groups within the profession should also assume this responsibility. The practitioner should not only learn the basic facts, but also keep up with new thoughts and progressive ideas as they are demonstrated from time to time by clinicians and research workers. It is important that these courses be wisely directed so that the student may obtain a broad vision of the basic biologic principles and so that his training does not overemphasize appliance technic. When the general practitioner has personal integrity of a high order and consistent loyalty to an ideal of service, and is not to be swayed by the expediency of financial gain; nor is he too bigoted to admit that he cannot perform every branch of practice, then the problem that we are discussing will cease to be a problem and orthodontic service of a high order will be received by all children. Whether it is rendered by the general practitioner or the specialist is of small moment if in the last analysis it is really adequate service.

A THIRD SURVEY OF DENTAL AMALGAM ALLOYS (1932-1933)*

By GEORGE C. PAFFENBARGER,† D.D.S., and WILLIAM T. SWEENEY†, A.B., Washington, D.C.

DURING its annual meeting held in September, 1932, the Research Commission of the American Dental Association requested that a survey be made of dental amalgam alloys purchased in the open market. Only those alloys guaranteed by their manufacturers to meet either the American Dental Association's Specification No. 1[1] or Federal Specification No. UA-451[2] for Dental Amalgam Alloys were to be purchased. The Commission further requested that these alloys be tested to determine whether they comply with their guarantee statements and that the trade names of the alloys tested be incorporated in the report.

In accordance with these instructions, thirty-five brands, representing twenty-one concerns, were purchased from various sources from June, 1932, to February, 1933, and tested. An endeavor was made to include all guaranteed alloys, but some may have been inadvertently missed. This could easily occur with locally made and locally consumed alloys. Every reasonable effort was made to make the list complete. No attention was given those alloys that did not bear a guarantee.

TESTS CONDUCTED

The alloys were tested for dimensional change on setting and for flow under stress. The procedure used in these tests is described in previous publications.[3] All tests were made in duplicate on all samples. If the first sample of alloy failed to meet requirements, an additional sample was procured from another supply house and several tests were made on it by different observers.

Crushing strength tests were carried out only in certain cases, as our experience in testing indicates that amalgams which meet the flow requirement have in every case met the requirement for crushing strength.

Chemical analyses were made on some alloys, among which were two brands made by one concern. One was labeled

*Publication authorized by the Executive Board of the Research Commission of the American Dental Association.

†Research associate for the American Dental Association at the National Bureau of Standards.

1. Taylor, N. O.: Specification for Dental Amalgam Alloys, J.A.D.A., 17:112 (Jan.) 1930.

2. Federal Specification No. UA-451 for Dental Amalgam Alloys; for sale by the Superintendent of Documents, Washington, D. C. (5 cents).

3. Footnote 1. Souder, Wilmer, and Peters, C. G.: Investigation of Physical Properties of Dental Materials (1920), Bureau of Standards Technologic Paper No. 157; for sale by the Superintendent of Documents, Washington, D. C. (10 cents).

TABLE 1.—CERTIFIED* ALLOYS WHICH MET A. D. A. SPECIFICATION NO. 1

Brand	Manufacturer
Argentum¶	Hammond Dental Mfg. Co.
Brewster¶	E. R. S. Brewster
Certified¶	Lee S. Smith & Son Mfg. Co.
Colonial	S. H. Reynolds Sons Co.
Dee¶	Thos. J. Dee & Co.
Diamond edge¶	Young-Baker & Co.
Minimax No. 161, 173, 177, 178#¶, 180, 183	The Minimax Co.
Mission No. 5	San Diego Smelting & Refining Co
Mynol	The Mynol Chemical Co.
Ney-Aloy#¶	The J. M. Ney Co.
Odontographic	Odontographic Mfg. Co.
Pearlol	Wildberg Bros.
S-C¶	Stratford-Cookson Co.
True dentalloy#¶	The S. S. White Dental Mfg. Co.
Twentieth century#¶	The L. D. Caulk Co.
White beauty	Lang Dental Mfg. Co.
White gold and platinum	The Manimax Co.

* Certified to the Research Commission of the American Dental Association by their respective manufacturers as meeting the requirements of A. D. A. Specification No. 1 for Dental Amalgam Alloys.
† One sample passed and one failed.
‡ Advertised as meeting the specification, but not certified to the Research Commission.
# Met the requirements in first survey (J. A. D. A., 16: 593 [April] 1929).
¶ Met the requirements in second survey (J. A. D. A., 17: 115 [Jan.] 1930).

TABLE 2.—ALLOYS WHICH DID NOT MEET A. D. A. SPECIFICATION NO. 1

Brand	Manufacturer
Decotized‡	Research Products Corp.
Minimax No. 172*, 174*	The Minimax Co.
Mission No. 6*	San Diego Smelting & Refining Co.
Modeloy*	Crescent Dental Mfg. Co.
New standard‡	The J. Bird Moyer Co.
P. D. Q.‡	Patterson-Hettinger Co.
Silverloy*†	Crescent Dental Mfg. Co.
67‡	Research Products Corp.
Wilkins*†	Crescent Dental Mfg. Co.

* Certified to the Research Commission of the American Dental Association by their respective manufacturers as meeting the requirements of A. D. A. Specification No. 1 for Dental Amalgam Alloys.
† One sample passed and one failed.
‡ Advertised as meeting the specification, but not certified to the Research Commission.
# Met the requirements in first survey (J. A. D. A., 16: 593 [April] 1929).
¶ Met the requirements in second survey (J. A. D. A., 17: 115 [Jan.] 1930).

"A perfectly balanced alloy—69% silver content," while the other was labeled "That lustrous white amalgam," and was stated to contain 67 per cent silver. When analyzed, both alloys were found to contain 68.4 per cent silver. It

Blackening of amalgam alloys.

is interesting to note that the bottles carried the same batch number and that there was a difference of 50 cents an ounce in price between the two alloys.

Tables 1 and 2 are based upon the results of these tests. Obviously, these lists cannot be regarded as absolute proof that all packages of the various brands are as represented in the tables. It is reasonably certain that the alloys listed in Table 1 are as advertised. Their makers have submitted evidence of this to the Research Commission and these tests have confirmed their claims.

BLACKENING OF AMALGAMS

Some of the amalgams tested appeared to be very dirty in that they blackened the hand and mortar excessively. They would also leave a dark smudge when the plastic amalgam was drawn across a piece of white paper. Different degrees of blackening are shown in the accompanying figure. The amalgams were merely drawn across the paper and the amalgam residue removed by shaking. Some of the alloys were very clean and were practically free from the tendency to blacken the hand or mortar. This is a simple test which any practitioner can carry out in his own office.

MIXING TECHNICS

The instructions for using these alloys, which should accompany the package, are often entirely missing or very inadequate. They should contain at least the following items: (1) proportions of alloy and mercury to be used; (2) type of mortar and pestle; (3) a statement as to whether the alloy and mercury are to be stirred or ground; (4) mixing time and speed (revolutions of pestle and number of times alloy is spread out and rolled up in the hand); (5) when and how the excess mercury is to be expressed, and (6) method of packing. It is entirely practicable to issue such directions as these. If the dentist is supplied with correct material accompanied by a correct technic, the responsibility for

good amalgam restorations is largely on him. In the list of safe amalgams (Table 1), there are enough variations in working qualities to satisfy the most exacting dentist.

PREVIOUS WORK

The initial Bureau of Standards amalgam investigation[4] was reported in 1920. With this work as a basis, a federal specification[2] for dental amalgam alloy was adopted, Nov. 30, 1925. Several years later, additional reports[5] were published giving the trade names of the amalgams studied. Thus, the tests and test methods have been available for as long as twelve years. With this information available to all interested parties, is there a valid excuse for one to make or use inferior amalgam alloys at the present date?

CERTIFICATION OF DENTAL MATERIALS

As an additional protection to the dentist, the American Dental Association lists materials which the respective manufacturers have certified to the Association as complying with its various specifications. This plan is mentioned in greater detail in other publications.[6]

The dentist can be reasonably sure of obtaining superior materials if, in purchasing, he insists on those which meet the Association's requirements. Many reliable manufacturers have filed with the Commission a formal guarantee pledging the firm to keep its product up to standard and are now including such guarantee statements in their literature and on the individual packages. The Research Commission desires that reports of this type be issued from time to time and believes it is a double protection: (1) to the dentist wishing to secure safe alloy, and (2) to the manufacturer willing to enter such an agreement. Obviously, alloys kept up to this standard should not be compared, on price basis, with other alloys. The dentist can materially influence this work by buying only certified materials guaranteed by their makers to meet the rigid requirements that have been adopted by his Association.

4. Footnote 3, second reference.

5. Footnote 1. Taylor, N. O.: Survey of Amalgam Alloys, J.A.D.A., 16:590 (April) 1929.

6. Footnote 1. Taylor, N. O., and Paffenbarger, G. C.: Progress Report on Research on Dental Materials (1931), J.A.D.A., 19:404 (March) 1932. Paffenbarger, G. C., and Sweeney, W. T.: Progress Report on Research on Dental Materials (1932) J. A. D. A., to be published.

VISUALIZING THE MOUTH AS A MASTICATORY UNIT*

By CARL W. HOFFER, D.D.S., F.A.C.D., Nashville, Tenn.

CONSIDER with me the mouth as a unit, and forget the one tooth with a cavity that the patient has pointed out to you.

We fill a large cavity or replace a missing tooth. The margins may be perfect, and the tooth form, according to the tooth we are replacing, may be good, but we have overlooked its coordination with the existing condition present, expecting the patient's mouth to be restored to its individual, normal occlusion. In a few days, the patient returns, telling us that he cannot use the tooth that we have just restored for him. We again inform him, probably, that it will be all right in a few days, giving an explanation that we probably do not believe in ourselves. Later, if we are fortunate enough to see the patient again, we find the soft tissue diseased and the filling out. We then try to lay the blame on the materials used; but if we are students or observing dentists, we will endeavor to determine whether any fault can be found with the original diagnosis. Most of our failures I believe can be attributed to a faulty diagnosis.

In thinking of the mouth as a unit, we have to consider the maxillary and mandibular teeth and their supporting tissues. The maxillary half of the mouth is stationary, except for the slight movement of the individual teeth. The mandibular half of the unit is movable, being capable of opening, shutting, and protrusive, retrusive and lateral movements.

We have been taught, and it has been proved clinically, that the mandibular movements in relation to the maxillary are within an arc or a sphere. It is therefore necessary that the occlusal surfaces of both halves of the unit conform to the same arc, if the mouth is to function normally in mastication.

The thorough knowledge that we have of the supporting tissues of the teeth makes us realize that the more teeth we put to work in the one sphere, the less the strain will be on any individual tooth. Single teeth will not stand the undue or abnormal stress of mastication for a long period without loosening in the socket and being lost. Even a few teeth will not stand it much longer. This being true, let us keep a careful watch on mouths that are in normal occlusal function, lest they be thrown out of balance:

1. By impacted or embedded third molars that cannot erupt. These teeth, in their attempt to erupt, cause shifting of the teeth that are in normal occlusion. This shifting is very often enough to throw individual teeth into malocclusion.

*The papers of Drs. Hoffer, Schott and Spalding were presented as a symposium.

*Read before the Section on Periodontia at the Seventy-Fourth Annual Session of the American Dental Association, Buffalo, N. Y., Sept. 14, 1932.

The following may happen: The pressure may be exerted on the lower anterior teeth, causing their overlapping. It can cause elongation of the lower second molar, and often a rotation out of occlusal alinement of the first or second molar; and, not infrequently, the second bicuspid is crowded lingually out of occlusion. It has grieved me to see, in a number of cases that, in the upper arch, the second bicuspid and first molar have been crowded lingually out of occlusion on one side of the jaw by pressure from the maxillary third molars. Great deformity will develop in a short time in all these cases if the occlusal relation of the jaws as a unit is not reestablished and maintained.

2. By loss of any of the first permanent molars, especially in the younger patients and in the lower jaw. These should be replaced immediately, since there is a drifting or tipping of the approximating teeth, attended by loss of contact of the teeth in the same area. This loss of contact and tipping of teeth at once jeopardizes the soft tissue and invites pyorrhea. It also throws extra stress and strain on these tipping teeth, thus hastening their loss and an interference with the normal function of this unit in its movements within the occlusal sphere. What happens to the mouth? The teeth that have drifted have taken on the now uneven strain in their weakened, shifted position that was distributed over thirty-two teeth with no interference.

3. Teeth that are malerupted or are out of this occlusal sphere and not properly taken care of by orthodontic treatment will soon destroy the function of the mouth as a unit.

We have cases every day coming under our care that present one or all of these conditions in the loss of supporting tissues and teeth by uneven wearing. What shall we say to the distressed, discouraged patient? "All out," and many of these teeth are good. Or will you use your practical, mechanical knowledge and establish a new occlusal balance that includes most of the remaining teeth, and build, grind and move the rest of them into proper relationship?

I do not want to give the impression that it is necessary to open the bite, so-called, or increase the vertical dimension, in every case, in order to establish occlusal function, but it is necessary many times to reestablish vertical dimensions in order to attain the best results in older persons.

In practically every case, we have obtained an increase in hearing, and, in several cases, it has been very noticeable to the patient. This was especially so in one case as determined by the otologist. We have the readings of the patient's chart before and after treatment, showing an increase in hearing of 60 per cent, and this has been maintained for three years. Not only has this been done, but the patient reports a marked improvement in mental attitude, stating that she views life from an entirely different standpoint and is able to meet existing conditions as they present themselves much easier than she has been able to for the past ten years.

In the reconstruction of cases in which the posterior teeth have been lost and a great deal of the support of the remaining teeth is gone, amazing results have been attained by the use of the so-called continuous lingual clasp, or the Kennedy bar, in connection with the Chayes or slot attachment for bridge or partial denture construction, this bar being used as a balancer or splint.

I do not know of a greater calamity that can come to a proud person than to be told that he has to lose his teeth.

ONE PIECE CAST RESTORATIONS*

By CARLOS H. SCHOTT, D.D.S., F.A.C.D., Cincinnati, Ohio

THE pioneers in dentistry possessing mechanical genius had, I am sure, a vision that we might some day be able to pour or force metals into a mold, reproducing appliances to replace lost dental structures in a much better way than was then possible, and so, throughout this comparatively short period of years in which dentistry has been a recognized profession, there has been continuous progress through the contributions of one man after another in bringing about the present status of castings. In this respect, we must credit the great contributions of our scientific metallurgists and the United States Bureau of Standards. Comparing the results with those of former methods used and those still being used, we are forced to stop and wonder. Like the acceptance of the fact that the earth is round, it may be a long time before we can convince all of the profession of the possibilities in the one piece casting.

I shall not attempt to compare the value of fixed bridges with that of removable. Each has its place. I shall discuss the merits of the removable one piece cast restoration where indicated and, rather than dwell on its successes, I shall emphasize those points which, in my opinion, cause most of the failures of the one piece casting.

TABLE 1. — EXAMINATION ROENTGENOGRAPHIC AND CLINICAL

Supporting Structures	Soft Tissue (Gums)
	Hard Tissue (Bone)
Teeth	Vitality
	Types
	Length
	Mobility
	Defects
	Occlusion

TABLE 2. — DIAGNOSIS AND PREPARATION

Mental Design	
Study Models	
Balancing Occlusion	
Restoration of Defects	
Grinding for Rests	Anchorage Teeth
	Opposing Teeth
Polishing Ground Teeth	

Changing dental standards are forcing us to think in terms not only of mechanical service but also of health service.

Our failure to restore lost teeth, especially when the mouth tissues are involved, is one of the commonest causes of failure in periodontal treatment, for maintenance of the health of the supporting structures is dependent on restoration to functional occlusion with the simplest type of appliance.

Comment has been made on the clinics given at our dental meetings that there are too many methods advocated, all of

*Read before the Section on Periodontia at the Seventy-Fourth Annual Session of the American Dental Association, Buffalo, N. Y., Sept. 14, 1932.

which accomplish about the same end result, and many of which complicate the situation. Many methods that are scientifically correct will not always prove practical.

In building a structure, we observe first the foundation on which the structure is to be placed. So it is, or should be, in any dental restoration work. I do not know of any problems that need more accurate engineering than those of dentistry.

Our first step, then, is an examination, roentgenographic and clinical. The soft tissues must be in good health, which means that they must be free from gingival irritation or swelling and free of pus-forming pockets. There must be sufficient stability and support of bony structure and the teeth should be vital. The teeth should be well supported, at least one third or more of the bony support remaining. This depends on the character of the bone and the patient's ability to repair it, which is dependent on his general health condition. Therefore what would be satisfactory in one case might not be when the general health was impaired. We should not use a tooth on which the extra alveolar leverage is too great, and we should study the occlusion. In my opinion, more than half of the failures in one piece cast restoration cases come as a result of inadequacy of the general examination and the selection of a suitable means of restoration.

Assuming that the defects in the teeth as well as of the occlusion have been restored as nearly to normal as possible, we can then make a diagnosis and offer a prognosis. The patient has a right to know what to expect and, in this connection, may I warn you not to promise too much, which is an error most of us make. There are too many changes in the mouth over which we have no control; and crutches will always be crutches, and the patient cannot expect 100 per cent results, nor should we promise such results.

As for study models, they might as well be the original master models, as most study models made in the common

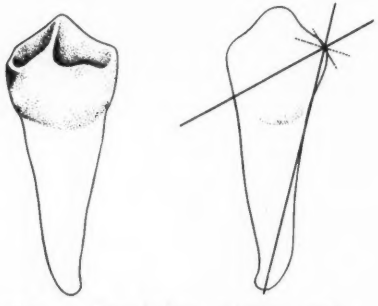

Fig. 1.—Dotted line: Correct angle at which to grind for rest lug. Line to right: Proper direction of stress in line with long axis of teeth. Short line, above: Incorrect angle at which to grind. Long line, above: Improper direction of stress causing soreness and resulting in failure.

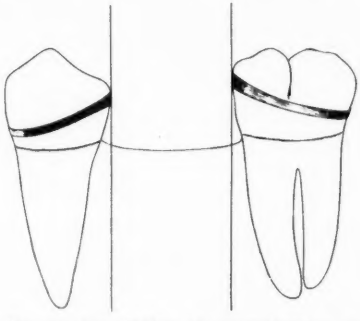

Fig. 2.—Paralleling of approximating surfaces of teeth to be clasped by carving impression of teeth before pouring model, trimming to be done at point just below contacting surface where clasp is to engage tooth. The clasp is to be carried around the greatest circumference of teeth in order to stabilize tooth as well as appliance.

way are a complete waste of time. After you have determined by careful examination that the one piece cast restoration is the most desirable for the case, we establish our design mentally. In the selection of the restoration, it is well to favor the simplest type possible, the type requiring the least amount of readjustment. The less complicated the appliance is, the better, and in the well engineered and properly designed removable one piece casting, we have the most desirable type of restoration. I have no criticism to offer of the man who is technically above the average and who can make the more intricate appliance well, but the average man will produce a better grade of restoration with the one piece casting, with the aid of an intelligent technician, than he would make attempting the more complicated type.

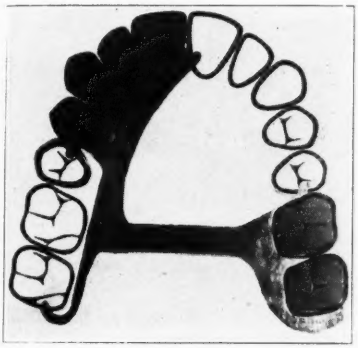

Fig. 3.—Equal distribution of stress.

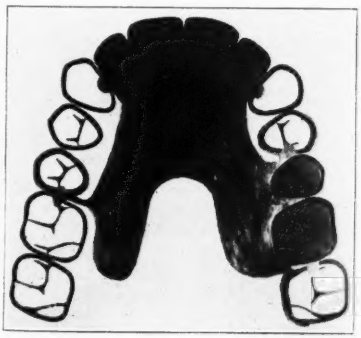

Fig. 4.—Horseshoe type involving anterior teeth. Where other teeth are to be supplied, this design will maintain better contact points between cuspids and bicuspids.

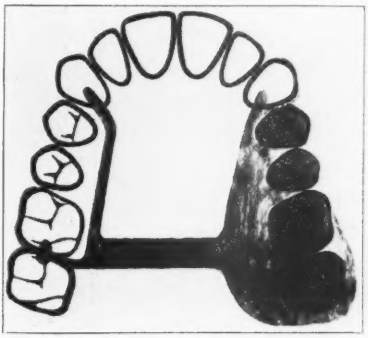

Fig. 5.—Partial unilateral case simplified by design shown in Figure 4. The indirect stabilizer and retainer may be noted.

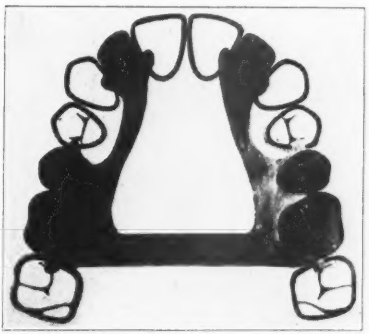

Fig. 6.—Six-tooth restoration with stress distributed on eight teeth.

The next step is the preparation, i.e., the restoration of defects, and in this

connection may I suggest that silicate fillings in cervical or other cavities where clasps and rest lugs make contact should not be used, or, if they are, they should not carry with them too much promise. Instead, wherever possible, baked porcelain or gold should be used to attain the desired results.

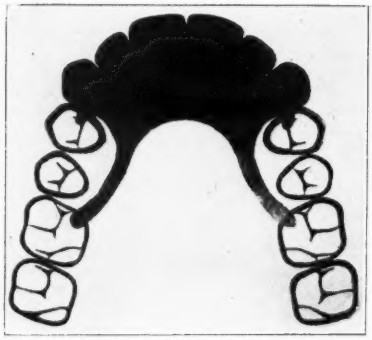

Fig. 7.—Incorrect design, depending on two clasped teeth.

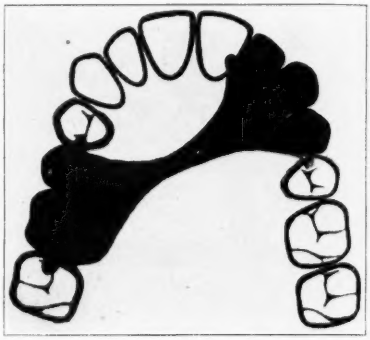

Fig. 9.—Improperly designed palatal bar.

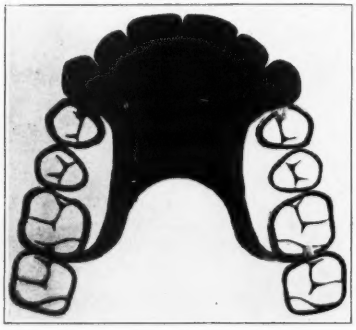

Fig. 8.—Correct design: four clasps used but six teeth carrying load; saddles carried back in line with first permanent molar for greater comfort to tongue.

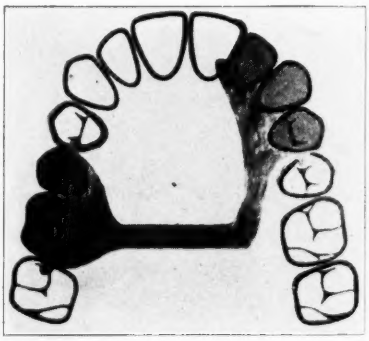

Fig. 10.—Correct design: grip clasp on central incisor, also using rest on molar instead of clasp.

Supporting and opposing teeth are then ground for rests. This step should be given serious consideration. In grinding marginal ridges or cusps for rest lugs on supporting teeth, we should grind no more than will permit of a sufficiently strong rest lug to carry the necessary stress of the bite, and in order to prevent overgrinding of the supporting tooth, it is far better to grind the opposing tooth, which does not carry a rest lug and is thus more readily self-cleansing. Also, the rest lugs are ground at such an angle that the stress will be directly in line with the long axis of the tooth rather than on a plane which would cause a regulating pressure on the tooth and create soreness in the sup-

porting as well as the adjoining teeth. When the grinding is finished, the ground surfaces of the teeth must be thoroughly polished. This practice, so commonly neglected, is one of the causes of failure and of sensitiveness of the teeth.

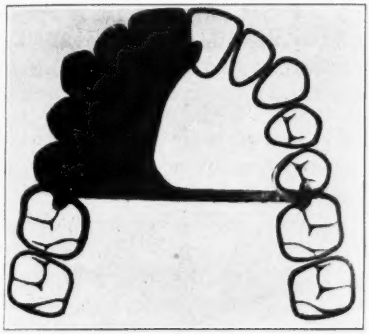

Fig. 11.—Incorrect design, very uncomfortable and with many discrepancies evident.

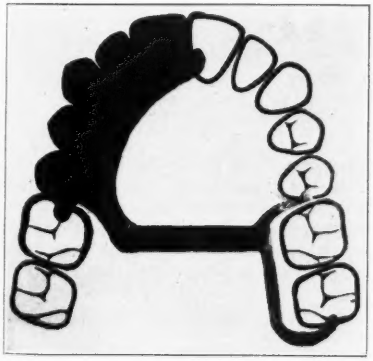

Fig. 12.—Correct design, with stress more equally distributed. The clasp can often be used on the second molar where the indirect retainer is shown.

It should be needless to emphasize the great importance of accurate impressions, whether taken with compounds, plaster or plaster compounds for the master model, as well as for the model of the opposing teeth, and there should also be a wax bite accurately taken. The preparation of impressions and making of models is commonly the work of the technician, but we should not depend on him for the designing of the case as

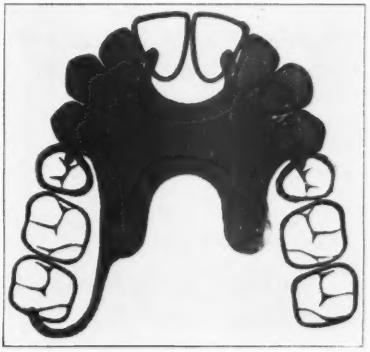

Fig. 13.—Correct design, with grip clasps on central incisor. There is one indirect retainer used, though two are sometimes indicated.

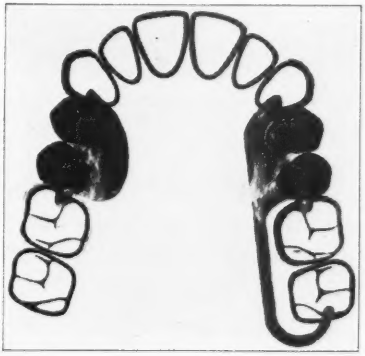

Fig. 14.—Two types. Where the cuspid is short, an indirect retainer is used on the molars.

it is important that we superintend the designing in cooperation with the technician, since we are seeing the mouth

and he is seeing only a model. The negligence of the dentist in this respect is another cause of failure of a case.

Failures also come from improper fitting and from not grinding the teeth to occlusion before cementing them. We should fit the appliance, do the necessary grinding on the rest lugs and then grind the teeth before the cementing. We should check the bite again after cementing the teeth and placing the appliance, as a balanced occlusion is most essential to success.

Removable bridges should be examined and the occlusion checked regularly on the patient's return for prophylactic care as the wear on artificial dentures is not the same as on natural teeth, especially in tooth-bearing appliances.

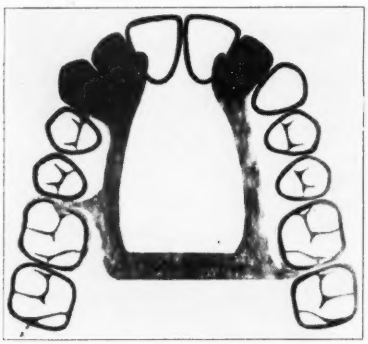

Fig. 15.—Case made without sufficient consideration of all periodontally involved teeth.

From my observations in the past nine years, in which time I have made a clinical check-up of hundreds of cases, I have found, when the dentures were correctly designed and the stress properly distributed, an improved condition of the bone and increased stabilization of the teeth, the appliance in effect being the same as a carefully designed fixed bridge, with the added advantage of being more easily kept clean.

The one piece cast clasp will show no greater wear or damage to supporting tooth structure than, if as much as, any other type of clasp, provided that clasp fits correctly and there is a minimum of frictional wear due to the movement of teeth and appliance. Appliances can be made so that there is practically no movement.

CONCLUSIONS

We see so many mouths wrecked through premature or necessary loss of teeth from extensive infection and periodontic involvement and must recognize that to allow these cases to go unrestored spells ultimate failure for us in our work, regardless of how well operations are performed.

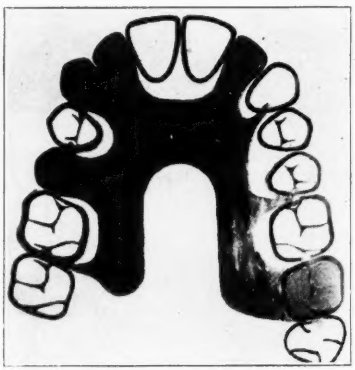

Fig. 16.—Case shown in Figure 8 after removal of periodontally involved devitalized teeth and elimination of stress from central incisors. A T clasp was added between the biscuspid and molar where a deep pocket existed. Food impaction was thus prevented.

The majority of those who constitute the clienteles of the thinking and more progressive dentists are of the conservative class, who are unwilling to sacrifice

teeth, a tooth or any part thereof, and I believe that, in the one piece type casting, when properly designed and made, we have a most conservative and satisfactory restoration and one which can be comfortably adjusted to the teeth and does not necessitate the adjustment of the teeth to the appliance as claimed by some.

If the abutment teeth are perfect or well filled and, by a minimum of grinding preparation and with an impression and bite, we could fill a space satisfactorily, would we not rather choose to do so than to employ a method requiring much more grinding in preparation, a series of impressions and fittings and all the disagreeable steps that the latter method necessitates? Only what we would choose for ourselves should be advised for our patients.

The principles involved in the making of removable appliances, whether they be one piece cast or assembled, are quite the same as in the making of fixed appliances, and the more closely removable appliances approach the fixed bridge in effect, the more successful they will be, if they are in good occlusal relationship and balance. All restorations are, of course, only substitutes or crutches. It is most important to have frequent checkups on all bridges in order to maintain occlusal harmony. I feel that the failures in one-piece cast work are largely due to failure to carry out a definite and correct technic and are not to be blamed on the method employed.

Theoretical opinions count for little; opinions based on proof establish facts. I hope that what I have presented of my own experience will convince you that one piece cast bridges, simple and cleanable, properly designed and fitted, have a definite place in the maintaining of dental health. Finally, if we would raise our profession to the highest plane, we must practice dentistry as a health service and not as a mechanical profession.

BRIDGE SELECTION BY THE PERIODONTIST*

By EDWARD B. SPALDING, D.D.S., F.A.C.D., Birmingham, Mich.

WE may safely say that no group of dentists, be they general practitioners or members of any specialty of dentistry, view dental bridges with a more critical eye or with more anxiety as to their function and their influence on the other teeth than do the periodontists.

In all mouths, constant change is going on in and about the teeth. This may consist of only a slight wearing of the cusps and inclined planes which results in slow changes of the relations of all the teeth. On the other hand, the change in relationship of the teeth may be rapid owing to changes in the crowns resulting from caries or new restorations; or it may be caused by a weakening of the supporting structures of one or more teeth or by the loss of teeth. It is our

*Read before the Section on Periodontia at the Seventy-Fourth Annual Session of the American Dental Association, Buffalo, N. Y., Sept. 14, 1932.

responsibility as dentists to delay these changes or to hold them in abeyance by whatever means is called for.

The purpose of a dental bridge is not only to supply teeth for esthetic reasons, but also to prevent the migration, tipping or extrusion of the abutment teeth with their detrimental effects on the occlusal and approximal relationship of the teeth, and to assure suitable occlusion for the opposing teeth.

The periodontist knows that a bridge introduces into the mouth an artificial condition which may shorten the life of the abutment teeth, also that of the opposing teeth as compared to their term of usefulness had no bridge been necessary. We are not unmindful of the fact that, in some cases, the life of these teeth is prolonged by the insertion of the proper kind of bridge, which stabilizes the abutment teeth and affords reasonable function to the opposing teeth.

The correct bridge to select, then, for a specific case would be the one which would promise the least destruction to, or change in, the remaining teeth in the mouth, their relationship to each other and the periodontium.

Nature arranged the teeth suspended and supported in the periodontium so that they yield when the inclined surfaces come into occlusion. If this were not so, a person would rarely reach maturity with a full complement of teeth; on the contrary, many tooth crowns would be fractured and the periodontium mutilated, not to mention the effect on the nervous system. We are all familiar with the difficulties involved in keeping fillings in the teeth of end-to-end bite cases.

If we place a fixed bridge in the molar and bicuspid region of the mandible, we have established a condition of the anvil and the hammer, the bridge representing the anvil and the upper occluding teeth the hammer. If the anvil does not yield, the hammer must rebound. As the movement and yield of the abutment teeth have been very much lessened by the fixed bridge, the upper teeth must have added to their normal yield the amount taken away from the lower teeth held firmly by the bridge, as otherwise the teeth will fracture. For the same reason, periodontoclasia is frequently found about the teeth occluding with a fixed bridge.

In the construction of a fixed bridge, the occlusal surfaces of the porcelain pontics are usually covered with gold heavy enough to withstand the impact of occlusion in order to protect the pontics against fracture.

If it is necessary to protect the anvil, is it not also essential to consider the hammer? Cases of fracture of natural and artificial crowns of teeth, pulpitis, devitalization of pulps, loosening of teeth from trauma and periodontoclasia, associated with teeth opposing a fixed bridge, are of common occurrence.

It is not intended to convey the idea that all teeth occluding with a fixed bridge are headed for immediate destruction, for, with the occlusion nicely balanced and adjusted at the time of the insertion of the bridge, it may be a period of years before the insidious influence of rigidity is manifest, but as the teeth on the opposite side of the mouth wear, the load becomes greater on the bridge which wears more slowly and demands an increasing compensatory yielding of the opposing teeth, whereby they or their supporting tissues may be injured. It is understood that the occlusion should be checked from time to time to relieve excessive stress, but, owing to the indifference of some dentists and many patients, this is not done,

and disaster follows as a result. Since, as was stated in the beginning of this paper, the changes in the relationship of the teeth may develop slowly, the patient is often not conscious of any abnormality until he has loose or fractured teeth, or an inflamed pulp, the latter frequently resulting from trauma.

Much has been said about the destruction of the periodontium surrounding the abutments of a fixed bridge, but, with the care and skill which is used in designing and constructing by the more particular operators, the fixed bridge with its nicely adapted porcelain pontics may be cleanly, and the slight thickening of the periodontal membrane observable in many roentgenograms about fixed bridge abutments is more probably physiologic than pathologic.

We have all observed fixed bridges of one or two pontics which have given satisfactory service for many years as far as the bridges were concerned, but have we observed and noted the effect of the bridges on the opposing teeth? If these observations are made, we feel that the conclusions will often determine the type of bridge to be used for a specific case. If the roots of the opposing teeth are long and set in a healthy periodontium with a heavy alveolar process, the crowns of these teeth, especially if weakened by caries or fillings, are liable to fracture if a fixed bridge is inserted without careful and continual checking of the occlusion. If these roots are short, or the alveolar bone is thin or not well calcified or weakened by disease, an unyielding opposing force in the form of a bridge is quite apt to result in destruction of the tooth attachment.

If the teeth to be used for abutments are in a loosened condition on account of overuse or torque in occlusion and need stabilizing, the bridge fixed at each end may prolong the life of the abutments by relieving them of the excess movement which was heading them for destruction. In this case, the bridge itself will not be the rigid anvil of one with firmer abutments, a condition favoring both the bridge and the opposing teeth.

The use of the semifixed bridge is an admission of the need for greater flexibility between the abutment teeth, but semifixation grants little freedom to the opposing teeth.

The normal yielding of both the abutment and opposing teeth in bridgework is, in my opinion, more nearly met by some types of removable bridges. The fact that a bridge can be removed from the mouth for cleansing purposes is not its only claim for recognition.

Some removable bridges are, when in place in the mouth, as immovable as the fixed bridge, and they have the disadvantage of straining the abutment teeth in removal and insertion. If the abutments are examined, they will often be found loose or not so firm as when the bridge was first inserted.

A removable bridge should be constructed for carrying the load, for retention and for function, the last giving each abutment a certain amount of individual yield and also yield for the pontics; all of which lessens the shock to the opposing teeth. The term "yield" or "freedom" does not imply a visible movement of these teeth more than that of normal teeth in occlusion. It does not mean that a bridge should have a rocking motion back and forth buccolingually like that of a baby's crib. Too much movement is as bad or worse than too little. Stimulation can advance to inflammation and then to absorption. In order to be worthy of wide adoption, a

removable bridge should have been tested, over a period of years, by the designer and by others willing to adhere to the principles of design and construction of the originator and to follow up their cases in practice, noting the effect on the teeth and their supporting tissues. We have in mind at least three types that meet these requirements, the Gillett, the Chayes and the Roach. They are mentioned in the order in which they came into use, the Gillett having been used as early as 1905, the Chayes in 1911, or thereabouts, and the Roach possibly ten years later. While Roach claims to have used his bar clasp in 1905, he did not give it to us until much later. These types have all been in use a sufficiently long period to determine their good features and their shortcomings as well as their suitability to certain types of cases.

In spite of the contentions of some designers, the universal or perfect removable bridge has not yet been introduced and I doubt that it ever will be, but when we are familiar with the principles of function, design and construction of several proven types, we can usually select one that is suitable to the case in hand.

The selection of a bridge type is influenced considerably by the condition of the natural crowns of the teeth to be used for abutments. If we have virgin enamel and dentin, it would be ruthless to cut deeply into them for the sake of an internal attachment for a bridge, except as a last resort. When there are large fillings in these teeth, we may be justified in making such additional preparation as may be necessary for an inlay for a fixed bridge or for the housing of a Chayes attachment; but if the fillings are small, the Gillett type of attachment is more suitable, since it can be used in a moderate size inlay. If there are no fillings in the proposed abutment teeth, other conditions being suitable, the Roach type would probably be best, since it calls for only a little grinding of the marginal ridge.

If we have a desire for saddle stimulation, we should choose the Gillett or Chayes type, for there is little stimulation to the saddle of a Roach bridge.

CORRELATION OF SYMPOSIUM

By T. W. MAVES, D.D.S., Cleveland, Ohio

THE period in which we are living is one of change. Almost daily, we are made to realize our limitations, and we become conscious of the outstanding fact that crown, bridge and partial denture construction has been challenged during the past twenty-five years. The time is opportune for us to take inventory of our past mistakes in bridge and partial denture work, since the investing tissues give evidence, microscopically and macroscopically, of pathologic processes which obviously are destroying soft tissues and bone, are fol-

Jour. A. D. A., April, 1933

lowed by the loss of many teeth and, finally, through years of toleration, impoverish the blood stream, lower the patient's resistance and undoubtedly imperil health.

Hippocrates said, "As the blood stream, so the man, just as weak and just as strong." Another well stated, "Blood is ourselves in solution."

Due consideration must be given dental foci of infection and the sequelae of infection, and the correct functioning of abutments, bridges and partial dentures.

Here, we might well ask ourselves: Do we, as a profession, sufficiently appreciate the magnitude of our responsibilities?

As a profession and exponent of the healing art, we at all times must have as our chief aim the conservation of health. As the teeth and their environmental tissues play a fundamental part in health conservation, we are called on to acquire a thorough knowledge of histology, physiology, and pathology, especially those phases which are relative to the field in which we are working. Sir William Osler said, "There is not one single thing in preventive medicine that equals mouth hygiene and the preservation of the teeth." Charles H. Mayo, in 1930, stated that 75 per cent of infectious disease has its origin in the mouth; and in the January issue of the *American Dental Surgeon,* William Hunter, of England, says,

> The degree of oral sepsis cannot be expressed in terms of "infected teeth," as some observers do. It must have regard to all the other conditions present—of septic gingivitis, tartar deposit, ulceration and pocketing, pyorrhea; of peridontitis and osteitis, shown by recession of gums or looseness of teeth, or by thickening of alveolar margins; number of carious or necrosed teeth; number of devitalized teeth (nerves destroyed); number of teeth with gold caps or porcelain crowns, gold bridges (a very potent form of sepsis, especially in regard to its neurotoxic effects); and finally to conditions revealed by radiographs or apical abscesses and granulomata, of buried roots, of impacted or unerupted teeth.
>
> The amount of infection created by all these various conditions is far greater than anything ever found in connection with infected tonsils, and also far more virulent, since it is all in connection with bone tissues, which always enhances the virulence of a septic infection.

There is now an insistent protest against ill-fitting inlays, crowns and bridges. Knowledge without practical application is like a bow without a string. The ideal of perfection is followed only as far as happens to be convenient, and the most earnest appeals of scientific workers to the professional conscience awaken but a languid response.

Moreover, genius itself must be trained and developed before it can find expression. Fate seems to take a hand at this point also, and to decree that those who are to stand highest in their chosen fields must pass the severest discipline of circumstance before their gifts come to flower and fruitage. They come up out of great tribulation, through struggle and privation and hardship, before they attain the maturity of their powers.

Of such geniuses, with skill, ability and purposeful intent, we have many in the profession: (1) the man who perfected the precision attachment and who was father of the phrase, "form, function and nutrition"; (2) the man who designed, perfected and taught the use of the 18 and 20 gage wire clasp for partial dentures, and who was, too, an ardent worker for the conservation of vital tooth structure; (3) the editor and philosopher who wrote many articles on the value of correct tooth form, with effective and efficient carvings for inlays and crowns, and (4) the man who

taught us so much relative to taking compound impressions under equalized stress, coupled with muscle trimming.

The ultimate aim of crown and bridge workers must be an improvement in the health of the person for whom the appliance is designed; an opportunity that none of us can afford to miss.

We fully realize that much of the dentistry of the past stands indecisive at the crossroads; a new epoch is in the making. None of you here present will attribute to our profession any too large a measure of success in dealing with the prevention of the breaking down of dental tissues.

Just how successful we shall be depends on our willingness to admit our ignorance of the problem, as well as on our willingness to unlearn most of the things that we have practiced, and give ourselves entirely up to the realization that the teeth and environmental tissues are subject to certain definite, immutable laws of development and growth, laws which must not be interfered with by any mechanism or appliance that we may at any time insert in the human mouth. Physical life is made up of form, function and nutrition. It can be maintained in perfection only by a balance of the three factors named. A correct dental operation may be defined as one the result of which is conductive to the health of the individual upon whom the operation is performed. We understand the term "health" as the maintenance of the vital balance which is expressed by the normal functioning of all organs which compose the human body.

The abutment or natural teeth which act as supports for the bridge must simply serve to prevent the vertical displacement of it during mastication, and they must so interplay with the bridge that they will be kept from migrating. Outside these two requirements, nothing more should be expected of them.

Any completed abutment must be so made that it will assure a dental organ capable of exercising all natural functions. The bridge itself must, during mastication, gently, and to a limited extent, ride upon the alveolar ridge covered with the mucosa and be so constructed as to supply the intermittent stimulation essential for nutriment by the increased, pressure-induced circulation of the tissues.

Artificial restorations in the form of bridgework must be constructed so that they will not interfere with the maintenance of the hygienic balance essential to proper sanitation.

After twenty-two years of replacing missing teeth, I am convinced that the movable-removable types of bridges with precision attachments come nearest to fulfilling the foregoing requirements, in maintaining the correct balance, sanitation and health of the environmental tissues. This is our ultimate aim provided such attachments may be employed without jeopardizing the vitality of the abutment teeth.

Since our study, teaching and research up to the present time have been unable through preventive measures to check caries and prevent pulps from dying, it is obviously imperative that we continue our efforts to perfect our mechanical technic; for we are called on to deal with the ravages of decay, various types of restorations and the replacement of missing teeth.

Closely related to our subject is a consideration of the principles governing crowns and bridgework. Ever since the exigencies of accident or disease have caused the loss of teeth, the individual suffering from the loss has endeavored to supply the missing mem-

bers. Undoubtedly, a greater amount of ingenuity has been expended in bringing restorative dentistry to its high attainments than is true of any other branch of our calling. Nevertheless, the replacement of missing teeth by means of bridgework of any type is always a serious problem and is still far from solution. This is obviously true, because the remaining teeth or environmental tissues, or both, must assume the burden of function of the missing unit or units, and this in addition to the responsibilities incidental to their normal activities.

Dr. Ash, of New York, says, "There is but little variation from case to case in the ability of the alveolar ridge to support occlusal stress, transmitted through a restoration, except the tendency to gradual settling. But there is wide variation in the ability of abutment teeth to support, or even to retain either removable bridges or partial dentures. Briefly stated, the principal factors which govern the ability of abutment teeth to perform the duties which we may wish to assign to them are the load, the length of roots, and extent of their alveolar support, and the degree of tipping, if any, of the root from its normal position."

By the term "load," we mean the amount and direction of stress which the abutment teeth will be called on to support. This varies with the shape of the ridge and the density of the mucosa and also with the extent of the appliance. It goes without saying that the longer the root, the greater the ability of the tooth to support stress, that is, if the surrounding bone is healthy.

Therefore, it will be seen that the condition of the underlying tissues is the all-important consideration in fixed and removable bridges. In many cases, the bite must be opened, due consideration being given the balancing of occlusion, the spherical theory and Gysi's gothic arch, and the tracings carried to a successful conclusion in the construction of crowns, bridges and removable dentures.

Fixed bridgework has suffered from empiric methods applied indiscriminately by many members of the profession. Possible injury to the supporting natural teeth and the requirements of hygiene and sanitation have been largely ignored. The promotion and maintenance of health, the requisites in the replacement of missing teeth by any method, have been largely ignored because we have failed to give adequate consideration and value to "form, function, and nutrition."

Faulty occlusion plays a most important part in the exfoliation of either individual or abutment teeth. Stress in a direction and of a degree which the tooth is by nature wholly unprepared to meet is the hardest element to deal with in either fixed or removable appliances.

If we could make restorations so that the teeth would not be moved in function, the intention of Nature would be more nearly fulfilled. I have no pet theory of articulation and occlusion to promulgate, nor is this paper intended to be an exposition of any panacea for our troubles; but so important is the proper relation of the maxillary and mandibular teeth to each other that I feel justified in saying that the future of dentistry in all its branches depends on the solution and understanding of this problem by the rank and file.

I have found it safer to establish cusp relation in harmony with the condyloid path in the individual case, rather than to establish a new occlusion arbitrarily. Let us not forget that "function determines

development and structure" and "food and function equal force and form."

First, we recognize the necessity for analyzing the conditions found in the mouths of those requiring bridgework. These include the stability and number of possible abutment teeth and the character of the soft tissues and alveolar ridge centric occlusion and, most important, functional occlusion. From the diagnosis thus made, we can arrive at a decision as to the type of restoration to be employed. The stability of an abutment means virtually its ability to support, or retain, a fixed or removable bridge. The items governing this are the load, the length of the roots, the extent of their alveolar support, the degree of tipping, if any, of the root from its normal position, and the age and general health of the patient. Every replacement must be one of the following three types: tissue bearing, tooth bearing or composite, i.e., both tooth and tissue bearing.

To come down to the present time, the question is one of considering the opportunities of the present generation, embracing both modern knowledge and the experience of those who have gone before, and also of considering whether we have any cause to flatter ourselves on the progress we have made; whether, taken as a whole, the work of the present is much of an improvement over that of a quarter of a century ago. Certainly, a large percentage of the work done is no whit better, and much of it is worse, than that done twenty-five years ago, and does far more harm than good. At the present time, the profession is confronted with the burning question, "Is dentistry, for the average patient wearing crowns, fixed or removable bridges, and partial dentures, a liability or an asset, in terms of health service?"

CORRELATION

Dr. Spalding's paper is based upon considerations of positive health and his bridge and partial denture technic is based upon a knowledge of histology, physiology and pathology. The constant change in and about the teeth is one of the fundamental considerations for the periodontist because the entire occlusion as well as the restored occlusal surfaces and the teeth are continually subjected to this change after a mouth restoration has been completed.

If a fixed bridge is used in replacing missing teeth, and since there is a continual change going on in the mouth with natural wear and with the aging of the patient, the occlusion must be corrected from time to time by the relief of excessive stresses and unequal wear. Dr. Spalding asks when and where a fixed bridge would be placed in the mouth in relation to the opposing teeth and replies that a fixed bridge that has proper design and construction can be placed in the mouth provided the opposing teeth have long roots and are set in a health periodontium with adequate alveolar support and the periodontists or men in restorative work continuously relieve the excessive stress resulting from the continual change going on in the mouth.

The type of removable appliance selected by Dr. Spalding is based entirely upon fundamentals and a scientific foundation. If we desire saddle stimulation as well as a healthy mucosa with little or no change of the ridge and do not wish the abutment teeth to have a movement greater than their natural individual movement, precision attachments are the ideal in partial construction. The Gillett construction is recommended when tooth mutilation is to be avoided. The day of the heavy cast clasp has gone, since we are not interested in its ortho-

dontic features and wish to avoid tooth decay in partial denture construction.

Dr. Hoffer emphasizes the importance to the periodontist of a visualization of the relation of each tooth to its opposing tooth, the stresses and strains being equalized and a few teeth being prevented from carrying the load, to avoid periodontal destruction and disease. Dr. Hoffer also calls attention to the continual changes occurring in the mouth owing to wear and shifting of all teeth out of occlusion from the presence of unerupted and impacted third molars which causes the second molars to elongate and a number of other teeth to shift into malocclusion. Not only is a thorough diagnosis necessary to assure equal harmony of restoration, but it is also necessary from time to time to equalize the stresses on all mandibular as well as maxillary teeth that they may function in unity and harmony. He also brings out the fundamental fact that when malocclusion is pronounced, as when there is a marked lingual inclination of the maxillary incisors or decided abnormalities, the problem can best be solved by the cooperation of the orthodontist, the periodontist and the specialist in restorative dentistry.

In conclusion, Dr. Hoffer emphasizes that no man can be successful in the specialty of periodontia unless he has a knowledge of occlusion and principles of restorative dentistry, for his success in maintaining the health of the underlying structures depends on the absence of gingival irritation and periodontal lesions.

Dr. Schott says that our first step is an examination, roentgenographic and clinical, and the soft tissues must be in good health, which means that they must be free from gingival irritation or swelling, and free from pus forming pockets. He states that there also must be sufficient stability and support of bony structure and the teeth should be vital, also that our restorations should maintain a healthy condition by having functional occlusion.

Form, function and nutrition are fundamentals in all forms and phases of dentistry, and I do not wish to subscribe to any technic that in any way jeopardizes these fundamentals.

I am not in accord with one piece cast restorations, owing to the fact that shrinkage of gold has not as yet been controlled; also, our model material adds a second change of shape on crystallization, or hardening.

The cast clasp does not in most cases allow the abutment to so interplay with the restoration that the abutment teeth are kept from migrating into fields other than their own, causing periodontal disease.

The impression method used in one piece cast restoration work does not embody an impression for the saddles which is taken under equalized biting stress to produce proper function; enabling us to get an impression of the mucosa and bony structure establishing the three requisites of form, function and nutrition; form, pertaining to the shape and size of the saddle, function derived under biting stress, and nutrition obtained from the appliance or partial denture, by materially assisting Nature in the blood supply to the underlying bone and mucosa. Also, the assembling of saddles under slight pressure to the individual parts produces a better functional restoration than is possible with the one that is cast in one piece.

As a suggestion to the periodontist and specialist in restorative work for a partial replacement, my first choice would be the movable, removable type with precision attachments, and secondly, the Gillett type, with small wire clasps embodying the foregoing principles.

ESTHETICS IN DENTURE CONSTRUCTION*

By IRVING R. HARDY, D.M.D., New York City

BEFORE enumerating or attempting to describe the aids to esthetic considerations which may be employed in the construction of dentures, and which I hope to bring again to your attention, I shall endeavor to point out what I believe is a crying need for greater attention to the appearance of the appliances that we dentists construct.

The wearers of dentures, according to my observations, fall into two groups as far as the appearance of the teeth is concerned. The majority are wearing dentures which are not only obviously artificial, but, in many cases, also positively grotesque looking. We are forced to believe that the men who construct such dentures take the easy way out, perhaps leaving the matters so vitally important to proper appearance entirely in the hands of a laboratory, and then persuading the patient to accept the dentures, unsatisfactory though he may know them to be. Patients who are wearing dentures of this type are not receiving truly professional service, and their teeth, even though they function creditably, can never be any great source of satisfaction to them, nor cast any credit on the practitioner who made them.

Of course, some patients may in time become somewhat accustomed to an unattractive appearance, accepting it as part of an inevitable burden of those who wear dentures, but there are many sensitive souls who have suffered considerable mental agony, due solely to a realization of the fact that their artificial teeth were indeed obviously artificial.

A second, and I am sorry to state, much smaller group of denture wearers have been strong-minded enough not to accept the mediocre product which has been foisted on the more docile or have been discriminating or fortunate enough to select a practitioner who was not averse to putting at least some of his own handiwork into the construction of his dentures; a man who was not content to pass a standardized, stereotyped product along to his patient. This man may have employed one or all of the aids and artifices which can be used to promote esthetic considerations, and will have produced a result which may not be perfect in all cases, but which, in many, will be so natural looking as to virtually defy detection.

I realize that, in many cases, it is extremely difficult to achieve exactly the esthetic result that might be described as perfect, but I have found that the proper employment of the following processes will do a great deal toward enabling the dentist to build into his cases a degree of naturalness not to be achieved without such aids.

It is my belief that, in the vast majority of cases, the tooth form, tooth arrangement and tooth color with which

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Nature equips an individual blend well, and are generally harmonious with the other facial characteristics. Therefore, when we are fortunate enough to have seen the natural teeth, we had best take steps to register the appearance before the teeth are lost, and to this end we employ photography.

The most important picture to be taken is the one in profile, to register the facial contours and especially the lip positions, for it is proposed, in the finished dentures, to build the lips out to the position that they originally occupied, and it might be difficult to achieve this result without an accurate record as a guide. In many cases, there has been a distinct closure of the bite, which is due to the loss of some of the posterior teeth, and it is found wise to open the bite with blocks of wax or cotton rolls gripped between the remaining posterior teeth before posing the patient for a profile picture, so that, after the teeth have been removed, the photograph may be used for reference in building bite rims to proper contour.

Pictures taken of the full face, both in a position of rest and with the lips drawn back to show the teeth, may also be taken and will always serve as reference guides during the process of constructing dentures.

An article by B. L. Hooper gave me most of my ideas regarding the application of photography to prosthetic work, and C. J. Stansbery[1] has presented a profile enlargement method which I have gratefully adopted.

A second invaluable aid in establishing esthetic values is the securing of proper preextraction models of the natural teeth. One of these is taken with the bite-opening blocks used for the photographs in place, a piece of modeling compound, usually backed up by a strip of air-chamber metal, being molded over the labial surfaces of both the upper and lower teeth while the teeth are in centric occlusion. After this is chilled, removed from the mouth and poured in plaster, we have in one model a replica of the visible surfaces of the anterior teeth, the overbite, overjet and relative positions of the mandibular to the maxillary teeth. It will prove a distinct aid in assuring proper tooth arrangement in our dentures.

A high-sided tray filled with warm beeswax is used to take an impression of the natural teeth while they are still in the mouth, and, after the teeth are extracted, they are set in position in this beeswax impression, and plaster poured about their roots to retain them. These teeth are to be soaked in water for a few days before we construct the dentures, to restore their color, which will change if they are kept dry; and their use as a guide will enable us to imitate almost exactly individual tooth form and tooth color.

With the afore-mentioned records, we have secured invaluable aid to an esthetic result, and operators who fail to secure them, or their equivalent, not only place themselves under a severe handicap by sacrificing the opportunity to do so, but are guilty of something more than casual oversight in neglecting an opportunity for serving their patients.

In constructing dentures for cases in which we have these records, teeth are selected from a stock mold, as near in form and color to the natural teeth as possible. It will, of course, be impossible to get exact matches of both form and color, but the tooth form can be readily changed by grinding and the color can be altered by shading with mineral stains.

1. Stansbery, C. J.: Functional Position Checkbite Technic, J.A.D.A., 16:421 (March) 1929.

I should like to go into detail regarding the coloring of stock teeth with mineral stains, for I believe it to be one of the major aids for producing natural-looking artificial teeth. The idea is by no means new. Lawrence Baker, of Boston, wrote on the subject twenty-five years ago, and did beautiful work with stains at that time. Today, since we have at hand such excellent and, at the same time, very inexpensive equipment for the purpose, it seems strange that this work is not more generally done, as it enables the operator to produce results in denture construction that are scarcely obtainable in any other way.

My equipment for this work consists of a furnace which, with a rheostat to control the heat, represents an investment of less than $25. A few bottles of "1600" stain, some "1600 glaze," a glass mixing slab, some brushes and distilled water constitute the rest of the equipment.

May we suppose, now, that our problem is the construction of a maxillary denture to occlude with natural lower teeth. The impression has been taken and the bites have been registered, the casts mounted on the articulator and the proper stock teeth selected, the next step being the setting up of the teeth.

With the casts supporting the patient's extracted natural teeth and the plaster model of the upper and lower teeth in centric occlusion as guides, I grind each porcelain tooth to proper size and shape, imitating in the porcelain enamel irregularities, abraded and eroded areas and any deviations from perfect tooth symmetry that it is deemed wise to reproduce. As these teeth are ground, they are set up on the wax baseplate of the maxillary cast, and by constant reference to the centric occlusion model, each artificial tooth is placed in exactly the same position that the natural tooth which it is to replace once occupied. This care in tooth form and tooth arrangement is expended only on the six or eight anterior teeth, the teeth posterior to the first bicuspids, of course, being placed in positions best suited to the promotion of stability in the denture.

It is wise now to check the result in the mouth, to make sure that the tooth form and arrangement are satisfactory, and to make such modifications as may be necessary. When these changes, if any are required, have been made, the next step is the use of the previously mentioned mineral stains for coloring the teeth.

The anterior teeth are removed from the baseplate by warming the wax a little, each tooth being carefully removed. Thus, a socket will be left in the wax into which each tooth may be reset accurately when the next step is completed.

It is essential that the teeth be carefully cleaned before any staining is done, and to this end they are scrubbed with a stiff bristle brush and soap and water, after which they are boiled in a strong solution of washing powder and water. This boiling removes any wax or grease which might resist the action of soap and water only. I find it wise to examine the teeth with a glass before going farther with the work, to make sure that the surface to be colored is really clean and free from specks, which might escape the eye without the use of magnification.

The actual application of the stains used is very difficult to describe, but it is not of itself very difficult. With the natural extracted teeth as a guide for the colors to be used. I mix a little of each color or combination of colors of stain on a glass slab, using distilled water as a vehicle, and, holding the tooth in a pair of cotton pliers, paint the colors on

the tooth surface. The furnace having been previously brought to the proper heat, I hold the tooth up before the open door for a few seconds to fix the colors after they have been applied, and then set the tooth on a silex covered fire clay tray which is of sufficient size to accommodate six teeth. The tray, with the teeth so laid upon it that they do not touch each other, is introduced just inside the door of the furnace, left there for two or three minutes, and then put inside the furnace and the asbestos block door put into place. From three to five minutes is time enough to fire the colors, after which the tray can be removed from the furnace, carefully protected with a cover to prevent drafts from checking the porcelain and allowed to cool.

After the teeth are cooled, the glaze is painted on in a generous coating. This glaze is transparent and is not to be confused with some of the higher fusing glazes which, if applied in a heavy coating, tend toward opacity, and produce white areas. In applying the glaze, which is a powder and is mixed with distilled water as a vehicle, it is not absolutely necessary to have an even coat applied all over the surface to be glazed, for, during the firing, it seems that the coating evens itself out nicely.

The teeth are now fired a second time in exactly the same way that they were when the stains were fused, and, after they are cool, we find that the stock teeth have taken on a very life-like appearance, although they are sometimes a trifle too shiny. This high glaze may be reduced to a rather dull gloss by holding the glazed surface, liberally covered with wet pumice and kept continually so covered, against a rubber wheel mounted on the lathe. When this too shiny surface has been reduced to a rather satin finish, it will be seen that application of the heavy coat of the glaze over the underlying stains gives an effect of depth of color, which is extremely life-like.

For some years, I had been using high fusing stains, with an overlayer of 1,700 degree glaze, but the method here briefly described was suggested to me by Hubert Kohrman, of Danbury, Conn., and it gives better results than I ever achieved with the higher fusing glazes employed in a similar manner.

I trust that this technic for coloring stock teeth will not seem so time-consuming as to preclude its use. The method I have often seen attempted of using mineral stains on unaltered stock teeth over the original glaze is such an obvious subterfuge that it may tend to accentuate, rather than conceal, the artificiality of a prosthetic appliance, and I would ask that those of you who have seen stains so employed, and who have therefore judged their use as of dubious value, give them another try, using the method here outlined, and I believe you will find in them a weapon for combating obvious artificiality which will serve you and your patients most creditably.

This paper has so far dealt only with the handling of those cases in which efforts are made to supply a patient with teeth which are in appearance very similar to his natural ones; the comparatively simple matter of faithfully imitating the most visible parts of the natural dentition. The task of rebuilding a mouth when I have never seen the natural teeth is to me much more of a problem.

In such cases, I find that considerable help may often be derived from a judicious use of the fact of family resemblance. A woman, perhaps 60 years of age, wearing unsuitable dentures applies for new ones. If inquiry should reveal the fact that this woman has a daughter whose facial characteristics are like her

mother's, I feel justified in copying the tooth form and tooth arrangement of the daughter's natural teeth when making artificial ones for the mother. To avoid the distinctly incongruous effect of young teeth in an older individual, the precaution is of course taken of selecting a basic shade which will be consistent with the years and complexion of the patient, and the teeth are properly aged by grinding the incisal edges to simulate wear and the necks to imitate erosion, and by artistically shading the teeth with mineral stains. I find that the factor of family resemblance may prove a very distinct aid in puzzling cases when the more direct guidance of a few remaining natural teeth is lacking.

In that great number of cases in which there are no natural teeth remaining nor is assistance from a member of the family in obtaining proper tooth form and arrangement available, J. Leon Williams' method of selection will of course prove our only salvation. I believe that in applying this happily discovered formula, care should be taken to select teeth of adequate size, for, in observing the appearance of many dentures, I have come to the conclusion that one of the most common violations of the esthetic precept is the use of teeth too small for the case, and it is often an error which at first glance brands the restoration as spurious.

When the proper teeth have been selected, the task of arranging them in a natural looking set-up can be arrived at, as far as I know, only by a trial and error method, following the arch form as a guide, and avoiding where possible too great a symmetry in the arrangement. Sometimes a patient likes to remember that her natural teeth were very regular, and will insist on a rather symmetrical arrangement of the artificial teeth. If I must bow to the patient's wishes in the matter (and I certainly try to have the patient believe that I am open to suggestions from him), I find that by properly grinding and coloring the individual teeth, that is to say by making the individual teeth more or less asymmetrical, I can arrange them in an even set-up and still entirely avoid that deadly look of a row of porcelain blocks which brands so many dentures as artificial.

The introduction of a gold filling or inlay may be a great help in breaking the monotony of a symmetrical set-up. Fillings of a compound type are preferable: on the anterior teeth, mesio-incisal or disto-incisal fillings; on the bicuspids, mesioclusal types. Teeth which are to receive these fillings are colored slightly bluish around the margin of the filling, in imitation of the shadow cast by the gold through the enamel, or even the tiny leakage often seen in fillings which have been some years in place.

Some of the rubber substitutes with which the profession is now experimenting and which seem to be improving as they are used and perfected will, we hope, prove of great aid in those high lip line cases in which, up to the present time, it has been extremely difficult to achieve anything like a proper esthetic result. I have heard prosthetists suggest that the use of long teeth in such cases to avoid showing any rubber was a way out of the difficulty, but this cure in practice often proves worse than the showing of vulcanite. I have also seen the problem met by placing the denture so far up under the lip that while the patient truly showed no rubber, neither did he show any teeth. All together, there has been but one answer to these cases, and that is the rather expensive expedient of a continuous gum denture, and even this solution is not an ideal one,

for the weight and fragility of the denture might be nearly as great a drawback as its expense.

I have had considerable success in these cases by employing one of the phenol-resin compounds as a veneer over an underlying rubber base, in this way securing a strong foundation, with a natural looking gum, which, if it deteriorates, may be quite readily replaced without disturbing the body of the denture. The veneer must be fairly heavy to look well, as otherwise the underlying rubber tends to show through the facing and destroy the artistic effect. This method is, of course, a frank compromise, but it is nevertheless a distinct aid in achieving a lifelike imitation of natural gum where vulcanite rubber would not only mar but, we might say, nullify all the good effects achieved by a proper arrangement and coloring of the teeth themselves.

Perhaps the various steps in technic herein enumerated as aids to esthetic results in denture work may seem to some superfluous, but I have learned from sad experience that the task is difficult when every means possible is employed to bring about a proper result, and that I cannot therefore afford to ignore or neglect any aid, artifice, means or method which will lift the product of my handiwork out of the limbo of false teeth, and make it a factor of prime importance in restoring to the patient his natural appearance.

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DISCUSSION

Milton Cohen, New York City.: Dr. Hardy stresses the case of the patient who has some of his anterior natural teeth, a type of case which is not nearly so common as the wholly edentulous one. The skill of the dentist is more heavily taxed with the latter type, and it is this patient who must be pleased far more often than the one who has some of his own teeth left. Usually, staining of artificial porcelain teeth is done against the patient's wishes, and is is finally accepted only after a trial in the mouth of the patient, and then only if it is not overdone. It is difficult to overcome the natural antipathy of the patient to a truthful reproduction of his own teeth where fillings and decay are apparent when it is his desire to improve his appearance with a newer, cleaner and better looking arrangement of teeth in a denture, but, for all that, a light and not too obvious staining of the teeth is very desirable and the use of stains should be encouraged by the dentist. I take exception to only one statement which Dr. Hardy has made, that concerning the continuous gum case. He practically admits that this type of restoration most closely approaches the ideal, and then dismisses its use in an off-hand manner because of the expense involved. If it is agreed that, in addition to the restoration of the natural functions, the construction of a continuous gum case offers greater esthetic possibilities than any other prosthetic product now at the command of the dentist, the question of expense should be given the least amount of consideration, it any at all. The advantages of the continuous gum case over the vulcanite and the other resinous substitutes by far outweigh the objections of expense. The very desirable reaction of the tissues to the platinum base and the smooth porcelain surface; the thermal changes which are easily registered on all the underlying soft tissues; the true sense of taste that is communicated to the palate; the absolute cleanliness of the denture from a hygienic standpoint and freedom from attacks from the products of bacterial reaction on the platinum and the porcelain, and the ease with which it can be kept in a state of cleanliness are advantages accruing from the use of the continuous gum case. Dr. Hardy's objection to its weight is overcome by the use of a lighter gage platinum base; for example, No. 32 or No. 36, which has been employed with great success, and, as to the fragility of the material, instructions to the patient to use due caution while cleaning the denture will obviate any difficulty from that source. A fracture of the material while in function in the mouth is of rare occurrence and the ease of repair is also a distinct advantage. If the dentist should be deterred from the use of the

continuous gum case by the objections voiced by Dr. Hardy, in the hands of the careless patient even the simple vulcanite denture would be in a hazardous position.

Bert L. Hooper, Lincoln, Nebr.: As Dr. Hardy states, there is a lack of appreciation on the part of many dentists regarding the esthetic requirements of artificial denture cases. There is a brighter side to this situation in view of the fact that the dental profession is becoming more and more interested in esthetics as applied to denture construction. Whether the dental profession wishes or not, it is going to be forced to produce better dentures from the esthetic standpoint, as the public is becoming more and more educated to appreciate good looking and well cared for natural teeth, which, of course, makes them the more observant of artificial substitutes. The dentist who equips himself to appreciate and produce good esthetic results will find his services always in demand. Of necessity, in the past few years, much time has been spent on the mechanics of constructing comfortable and efficient dentures. With the knowledge and equipment accruing from this intensive work, the profession can produce dentures which are efficient and comfortable to the wearer. So intense has been the study of mechanics that, to some degree, we have lost sight of the esthetic requirements. It seems that it would be worth while to the profession to apply diligently the knowledge that we have of mechanics and add to this all the possible information that is obtainable concerning the esthetic requirements of the case. Those who have not indulged in an attempt to reproduce in appearance a natural dentition or to study and apply art in denture construction have missed one of the greatest satisfactions and joys that dentistry has to offer, second only to that which such service brings to the patient. The sooner the hearers and readers of this paper by Dr. Hardy take seriously to heart his message and put it whole-heartedly into practice, the sooner the joys and rewards of success will be realized. The following ideas are expressed, not in a sense of criticism, but rather as an additional suggestion. In mounting the natural teeth, I take dentocoll impressions of the natural teeth before extraction; pouring these with some hard cast material. When the natural teeth are all removed, a dentocoll impression is taken of this cast. The natural teeth are then placed in this impression and the mounting is completed. The advantage of this procedure is that the natural teeth, if removed at intervals, may be kept in a solution until all have been extracted and then mounted. Dr. Hardy has mentioned the difficulties encountered in the perplexing edentulous case, where no information is at hand regarding the natural teeth. It is only through the dentist's observation and application of knowledge gained thereby that satisfactory esthetic results may be obtained; and I know of no better way to gain this knowledge than to imitate the natural teeth as nearly as possible whenever records of the natural dentition are available. It is only by this means that sufficient skill and ability may be obtained to assure satisfactory esthetic results in the edentulous case. To assure an esthetic result throughout, it is essential that the base material imitate the appearance of gum tissue as nearly as possible. The phenol-resin compounds have proved most satisfactory in this regard, not only from the standpoint of esthetics, but also from the standpoint of comfort and efficiency. Looking beyond this paper of Dr. Hardy's, one can see a practice composed of many satisfied denture patients—patients who do not hesitate to smile or laugh, showing teeth that build facial character and facial personality.

A PRACTICAL DIETARY FOR CHILDREN*

By W. A. COTTON, D.D.S., New York City

THE subject "A practical Dietary for Children" would suggest that practical diets for children should be different from those of grown people. When a diet is practical for children, why is it not also practical for grown-ups, who live under the same immutable natural laws? The combinations of foods should be the same, only the quantities of necessity varying.

The boy whose mother was very careful about his diet and continually telling him that he shouldn't do this, and he shouldn't eat that, because it was not good for him was heard to mumble to himself that he would be glad when he was 21 because "you keep telling me all the things I shouldn't eat and all the things I shouldn't do, and when I get to be 21 I'm going to do everything that isn't good for me." This seems to be what most grown people do, and then they wonder why they have decayed teeth, pyorrhea, heart disease and other ills and why at least 65,000 die each year under the age of 40, of old age diseases.

Any individual, child or grown up, who is fed according to his or her power of digestion, assimilation and elimination, when there is no abnormality in the relationship of the teeth, and pits and fissures, if any, have been properly treated, will not have dental decay.

Irregularities, pits and fissures can probably be materially reduced in the child by careful attention to the food of the mother before and during pregnancy.

Before any practical diets can be evolved for children, there are a number of questions that must be answered. As this is the preventive dentistry section, I am giving diets for the prevention of dental decay, but we should have some conception as to how dental decay takes place, before any kind of diet for its prevention can be intelligently given.

According to the theory which is generally accepted, the carbohydrates or sugars that remain in the mouth in contact with the teeth split up into lactic acid and, after a time, this lactic acid dissolves out the calcium salts, thus forming a cavity. There have been many theories advanced for preventing this lactic acid from forming or remaining in contact with the teeth.

Pickerill conceived the idea of giving foods that would produce an alkalinity of the saliva sufficient to neutralize this lactic acid after it had formed and before it had time to attack the teeth. This did not succeed for the reason that the saliva is a digestive secretion and not a protective one. Also, the saliva is so variable in its alkalinity and its acidity that it could not be controlled by foods; and furthermore, Nature does not work that way. Nature never makes provision for disease by supplying a cure, but will proceed as best she can under disease or altered conditions

*Read before the Section on Mouth Hygiene and Preventive Dentistry at the Seventy-Fourth Annual Session of the American Dental Association, Buffalo, N. Y., Sept. 13, 1932.

and will do her best to return to normal when conditions causing the disease are removed.

The next idea presented was oral hygiene, which has accomplished more than any other artificial method. Some mouths it is impossible to keep clean. With others, hygienic measures are impractical. In still others, the results are pleasing. But we must not lose sight of the fact that there are many people who have never seen or heard of a toothbrush or oral hygiene and yet do not have decay.

According to another theory, if an antiseptic or germicidal dentifrice was used in oral hygiene, the problem of checking caries would be solved; which has not been the case as the mouth cannot be sterilized.

Vitamins were then offered as a solution; but how they can have any direct effect on the saliva or mucous secretion in their ability to prevent the formation of lactic acid, we cannot understand, except that they are necessary in building up and maintaining the normal body functions, which, of course, include the oral secretions.

Then there is the question of the lack of calcium and phosphorus balance in the blood. There is no question that this balance should be corrected, and food should be given to establish and maintain this balance. Here again, we are helping to reestablish normal digestive functions, which are necessary for an immune mouth. This balance of calcium and phosphorus will tend to harden the teeth to a degree, but we still lack proof that a hard tooth will not decay as readily as a soft one in the same enviroment, except, perhaps, that the process will be a little slower.

Still another solution has been offered, which is that the osmosis in the dental tubuli of the tooth will carry to the periphery of that tooth sufficient alkaline salts to neutralize the acid that has been formed on the outside of the tooth. All of these solutions probably have a bearing on dental decay. I do not believe that they have any direct bearing, but an indirect bearing; for by the feeding of natural foods that contain the vitamins and calcium and phosphorus in required amounts, we build up a natural resistance so that the body is able to protect itself and produce the enviroment in the mouth antagonistic to the formation of lactic acid.

The question now arises as to what the condition is in the mouth under which lactic acid cannot be produced. If any, or all, of the conditions mentioned are the answer to dental decay, we would not find 95 per cent of decay in the lower first molars and only 91 per cent in the upper first molars; only 57 per cent in the upper first bicuspids and 28 per cent in the lower first bicuspids; in the upper central and lateral incisors 60 per cent and in the lower 43 per cent. It does not seem reasonable that 12,000 persons, would all brush the upper molars better than the lower, and the lower anterior teeth better than the upper. Nor does it seem reasonable that the calcium and phosphorus content of the upper central incisors would be less than that of the lower, as they are calcified at about the same time.

There are some mouths in which we find no decay, and there are others in which decay will be present in spite of all our care and reparative measures. There must be some factors other than those mentioned in the immunity of the mouth to the action of lactic acid. The most obvious factor is the secretion from the mucous glands, which must have some function since Nature never produces and maintains a useless organ. These

glands are located not in the gums but in the lips and cheeks, where their secretion can be discharged directly on the teeth. On the lingual side, we find the glands on the edge of the tongue dipping down on the floor of the mouth where their secretion can also be discharged directly on the teeth. This mucous secretion is a thick viscid fluid which mixes very slowly, if at all, with either water or saliva. It is acid in its reaction and apparently is capable of inhibiting the carbohydrates from splitting up into lactic acid, thus creating an immune environment.

Yet we can have decay in a mouth where the environment is immune, since there are three reasons that teeth decay: (1) a susceptible environment; (2) defective relationships, or irregularity, and (3) flaws in structure of the tooth. Careful examination indicates that a large percentage of teeth are not perfectly formed and contain what are called pits and fissures. These pits and fissures are the result of imperfect calcification of the tooth along the developmental lines, and if a fine explorer can enter them far enough to sink below the surface of the tooth, where a toothbrush or the protective mucous secretion cannot reach, carbohydrate material can remain in these crevices long enough to be changed to lactic acid, and decay may arise from these pits and fissures, even in an otherwise immune mouth. This is also true of the relationship of the teeth. We seldom see a mouth that does not contain some irregularity, and the more pronounced this irregularity, the more places there are where food can lodge and remain in contact with the teeth and the protective mucous secretion cannot penetrate, and in time decay can develop in these areas in an otherwise immune mouth.

It is quite evident that diet alone cannot keep a mouth free from decay. Then what part does it play?

All secreting areas and glands from the outside of the lips to the anus are a part of the digestive tract. All these secreting glands and areas have the same nerve supply, the sympathetic nervous system, which is not under control of the brain. The taste and mastication of food starts the digestive secretions of the mouth, the stomach and the pancreas, the liver, and so on, all along the line. They are all interrelated, and if one area or gland is not functioning properly, this condition will in time be reflected to other secreting areas, affecting their function, and there is no reason that Nature should make any exception of the mucous membrane and its secretion.

There are four reasons that the mucous glands of the mouth may not function properly: (1) defective development; (2) local irritation; (3) influence on the character of secretion by the reflex stimuli of other areas of the digestive tract which are not functioning normally, and (4) an imbalance in the blood stream from which they derive the material for their secretion.

For the normal functioning of the digestive secretions, there are at least seven factors to be considered: (1) inadequate or otherwise abnormal secretion; (2) incompatible combinations of foods; (3) overeating; (4) inflammation or overstimulation of secreting glands; (5) bodily fatigue; (6) mental stress (such as anger, fear, sorrow), and (7) outside influences, which are many. One of the most common of the last mentioned is the toxic material derived and discharged into the digestive tract by the adenoids and tonsils.

The preparation of food within the digestive tract must be based on (1) the

chemistry of the digestion and (2) the mechanics of digestion, and by that I mean the mechanical movements that must take place at the proper time in order that the chemistry of digestion may function properly.

The chemical phase of digestion divides foods into three separate groups with three distinct modes of treatment before they are ready to pass through the intestinal wall into the blood stream: (1) carbohydrates, (2) proteins and (3) fats.

Each group has a distinctly different chemical treatment; and it is perfectly reasonable that these different chemical reactions cannot all take place in the same retort at the same time without some incompatibility.

A particular chemical secretion is required for each group of foods, and even foods of the same group require a different enzyme. The enzyme that will convert the starch of potato will not convert the starch of wheat.

Each food stimulates the secreting glands to produce the enzyme or digestive secretion that it needs. In health, Nature never makes the mistake of pouring into the stomach the digestive fluids for proteins when there are no proteins present. When starches are eaten alone and pass into the stomach, the secretions for proteins is not supplied. Digestion of the starches will continue for a longer time in the stomach and they will pass out more quickly when proteins are not eaten at the same time.

Let us see how each group is prepared for assimilation. The carbohydrates exist in three forms: the polysaccharids or starches $(C_6H_{10}O_5)n$, the diasaccharids $C_{12}H_{22}O_{11}$, which are cane sugar, beet sugar and malt sugar (these in a pure form, except malt sugar, do not ferment, but will quickly ferment when a monosaccharid is added and when fermentation takes place in the stomach, it is always acid and toxic), and the monosaccharids $C_6H_{12}O_6$, which are grape sugar and fruit sugar (honey is about one-half fruit sugar) and galatose (derived from milk sugar).

The monosaccharid is the only form that can be absorbed through the intestinal wall and be taken into the circulation. Consequently, the other two forms, the polysaccharids and the diasaccharids, must receive chemical treatment for reduction to a monosaccharid. The enzyme ptylin, which is found in the saliva, marks the first step in converting the starches to a monosaccharid. This is done by a thorough mastication in the alkaline mediums. This mass, after being thoroughly salivated, is passed on to the stomach. In the cavity of the stomach, there is no secretion which has any converting effects on carbohydrates. The reactions of the digestive secretions of the stomach are acid, and 0.4 per cent of acid not only stops conversion of starches but also destroys the enzyme ptylin, so that when the starches pass into the stomach, the conversion process is carried on until the acid of the stomach has an opportunity to permeate the mass and destroy the enzyme. Do not forget that the presence of proteins in the stomach not only draws out the secretions for protein digestion, but also causes muscular contraction of the stomach, which more quickly mix the acid with the carbohydrates, stopping their conversion.

At this stage of digestion, if their mastication and conversion has been carried to the point where they are sufficiently fluid, the starches are passed into the duodenum. If not, they remain in the stomach to ferment and be split up into acid end-products. In either case, if they remain longer in the stomach than they should, the fermentation end-

products add to the acidity of the stomach, which tends to use up the alkaline salts that are in that particular food. Furthermore, when this extra acid material is passed along into the duodenum, either less can be passed in at a time or the pancreas and liver must produce more of the alkaline bases in their secretions to neutralize this excess acid; for the material in the small intestine must be neutral or slightly alkaline.

When the starches have reached the small intestine, the conversion to a diasaccharid is continued by the enzyme amylase, and the diasaccharids are converted to monosaccharids by the invertin of the intestinal secretions. This completes the necessary conversion of the starches, as only a monosaccharid can pass through the intestinal wall.

Next are the proteins. The proteins as we eat them are in such a form that they must be reduced enough to pass through the intestinal wall. As there is no digestive secretion in the mouth that will have any effect on proteins, the proteins may be eaten in as large pieces as it is convenient to swallow. When they reach the stomach, the secreting glands are stimulated to secrete hydrochloric acid and pepsin, which are needed for the conversion of these proteins into peptones; after which, they are passed on to the intestine, where they are again further digested by the trypsin of the pancreatic juice. Do not forget that there is no secretion in the stomach that will digest starches, and that the presence of starches in the stomach does not stimulate the secretions for the digestion of the proteins, but when carbohydrates are eaten with proteins and pass into the stomach at the same time as the proteins, the proteins stimulate the secretions of the stomach for their digestion, and not only do these secretions, instead of assisting the digestion of the carbohydrates, stop it entirely, but the hydrochloric acid and the pepsin in many cases will attack the starch granules, producing fermentation, acid end-products and gas; and these acid end-products are toxic substances.

The third division is the fats. There is no secretion in the mouth that will digest fats. There is no secretion in the stomach that will digest fats, except perhaps a little butter. Fats are not subject to digestion until they reach the small intestine and are mixed with the enzyme lipase, which splits the fats up into fatty acids and glycerin.

Now you will suppose that a piece of toast or potato has been fried in fat, and the starch granules are encased or covered in a layer of fat. There is no way that the enzyme of the mouth can reach the starch to convert it. It certainly cannot be converted in the stomach, and it cannot be converted in the intestinal tract until it has passed far enough along for the lipase to dissolve off the fatty covering so that the convertible enzyme can reach it. Consequently, the chance of being converted into a diasaccharid has been delayed for some time. Therefore, no carbohydrates or meats should ever be fried as it puts an added strain on the digestive mechanism.

It is now evident why it is not wise to eat starches and proteins together or either of them encased in fat. The carbohydrates and the proteins, up to the point of entering the small intestine, have a totally different form of chemical treatment, the starches requiring an alkaline medium and the proteins an acid one, and, if eaten at the same time, each one interferes with the digestion of the other, which puts a strain on the digestive secretions and also creates toxic

material, as the different secretions have a deleterious effect on the food which they are not supposed to digest.

Of course, some persons have such a strong digestion that they can punish the digestive apparatus for years without any apparent bad effect; while other digestions not quite so strong will break down in a comparatively short time.

In giving diets to children, this point must be considered, for the digestive tracts of the children are in the process of development. Their glands and secreting areas are developing. The whole digestive tract is not only growing but performing its digestive function as well, and any extra strain that is put on it, such as from the presence of pus from tonsils or adenoids and difficult digestive combinations forming fermentation and toxic products, is usually just too much of a tax for the average child and digestion does not proceed as it should. The weakest areas would naturally be affected, with the result that the abnormal stimuli of these conditions are passed on to the sympathetic nervous system and, from there, to be mucous glands of the mouth.

The effect is that these glands no longer produce a secretion that will inhibit the splitting up of the carbohydrates into lactic acid, which is just half of a monosaccharid ($C_6H_{12}O_6$), lactic acid being $C_3H_6O_3$. This change in the mucous secretion does not cause decay, but allows decay to take place in proportion as the mucous secretion deviates from the normal.

With the foregoing in mind, we are now in a position to map out the food intake of the child in a manner that will be less irritating and put less strain on the digestive mechanism.

All we can give is a general outline, as each child should be fed according to its needs. Foods must always be compatible. I know that there are many who do not believe that there is any chemical foundation for the idea of incompatibility of foods, but application of this theory in practice means health to thousands, and injury to none; while, in the homes where incompatibility of foods is not considered, few children are free from decayed teeth, colds and many other ills.

It has been found best in making diets for children to give them one meal of fruit, or fruit and milk, another one of starch foods with nonstarchy vegetables and salad and a third meal of the proteins and nonstarchy vegetables and salad. Milk is a food, not a drink, and is digested best either alone or with fruits.

BREAKFAST

4 ounces orange juice
Unpeeled shredded apple with cream
4 ounces milk

or

Pineapple juice
½ dozen sun dried black figs softened with a little water, or small prunes, or dates
Milk

or

4 ounces grapefruit juice
4 ounces milk
Pear, peach, apple, banana or any fruit in season

or

Orange juice with yolk of egg beaten up in it
4 ounces milk
Any ripe fruit in season except melon

If a starch breakfast is desired as cereal, whole wheat bread or toast, or muffins or bacon, orange juice should not be eaten with the starches, but can be taken one hour before or two and one half hours after.

LUNCH

Baked or steamed potato and butter, or whole rice, or whole grain cereal, or whole wheat bread and butter with honey if desired.

A salad of lettuce, cabbage, escarole or ro-

maine with any left over vegetables, or raw grated carrots. A little cottage cheese may be used.

Lemon juice instead of vinegar should be used in the salad dressing.

In the middle of the morning or afternoon a glass of milk or fruit or both may be taken. A child needs from 2 to 4 glasses of milk a day.

DINNER

Soup, clear soups made from vegetables, no creamed soups or gravies.

3 to 4 ounces of lamb or chicken, or beef or cheese or fish.

2 or 3 of the nonstarchy vegetables (better steamed).

Salad of lettuce, cabbage, dandelion, spinach, water cress, or any of the salad greens with sliced tomato or any of the nonstarchy vegetables.

Dessert: apple, orange, junket, apple sauce, custard (no flour).

A fruit in place of the other salad is also a good dessert.

Children going to school can take fruit and get a glass of milk, or if they wish a sandwich of whole wheat bread with a filling of lettuce leaves or a filling of chopped figs, dates and raisins with a little honey, or whole wheat bread and butter with honey and a ripe banana.

These lunches can be taken in the middle of the morning or the afternoon if the child is at school.

Any of the foregoing meals can be substituted for another as long as the combinations are maintained.

THE BIOLOGIC CONCEPT OF ORTHODONTIA*

By HOMER B. ROBISON, D.D.S., Hutchinson, Kans.

ACCORDING to Dorland's "American Illustrated Medical Dictionary," biology is the science of living organisms, and of their structure, life, growth and actions.

Orthodontia, like all professional specialties, has experienced an unusual advancement. It has emerged from an almost purely mechanical phase to a more balanced concept, until now we attempt to make a diagnosis from biologic, physiologic and endocrinologic standpoints rather than mechanical. The wires are shaped or molded into a position that the orthodontist feels is best adapted to that particular case.

In other words, the orthodontic appliance is to us what the splint is to the surgeon. It is the special training that enables the surgeon to reduce the fracture and not the splint. The splints are not sent out promiscuously to inexperienced people, and neither should orthodontic appliances be. The appliance should be made to fit the case, not the case to fit a ready made appliance.

This brings us to the biologic concept of orthodontic treatment. It is quite difficult to deal with this subject without including the endocrinologic, physiologic and embryologic phases, for they are closely related. In fact, after viewing the subject from all angles, it occurs to me that, barring accidents, all types of dental anomalies are primarily biologic, and even many accidents could be attributed to biologic disturbances brought about by the deficiencies of va-

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rious ductless glands. To illustrate: A deficient thyroid gland may cause a tremor and lack of coordination which renders one much more susceptible to mishaps.

PRECONCEPTION

To deal properly with this subject, we must go back to preconception. Here, we may find one or both of the parents had been affected by disease. There are various diseases that produce a metabolic disturbance. The most common are tuberculosis and syphilis. One authority says: "To know syphilis is to know medicine."

Fig. 1.—Experimentally produced giantism in rat (right). Left, control animal. (T. J. Putnam.)

It is rather difficult for us to obtain the desired information, for usually the parents tend to conceal it, should they be aware of it. This suggests a reason for a closer relation between the physician and dentist. Should disease in a parent be ruled out, next in order for consideration is the embryonic stage.

EMBRYONIC AND FETAL STAGES

In our so-called civilization, frequently the prospective mother is subject to acidosis, extreme nausea and starvation (this, in many instances, being caused by a lack of a proper function or development of the corpus luteum, it has been proven that, in many instances, nausea gravidarum can be arrested by the use of extract of corpus luteum), sometimes even to the extent of osteomalacia, which, of course, will affect the mineral metabolism, and while the expectant mother will be sacrificed in favor of the child, still there is a limit to her ability in this regard and the time comes when the fetus will be deprived of certain elements necessary to give it the proper start. In fact, this so frequently happens that it is looked on as the normal. Why the human being is so far below the lower animal in its instinct toward a proper diet is of course a conjecture. It appears to me that, through our long period of indulgence and intemperance (mainly in eating), we have lost the sense of balance which the animal still retains. But it is obvious why it is necessary for a pregnant woman to have a proper diet and a perfectly working organism.

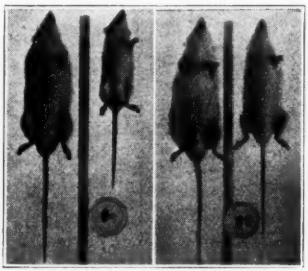

Fig. 2.—Left: Litter mate brothers; showing comparative size of testes of control animal and dwarf three months after hypophysectomy. Right: Same animals three months later; showing growth stimulating effects of substitution therapy on hypophysectomized animal and remaining testes. (P. E. Smith.)

The efficient stockman is cognizant

of this fact and guards his animals closely, but he, like many of us, fails to realize that his wife should receive the same consideration. So, doubtless, this is the stage at which many deformities begin.

LACTATION

Many fail to realize that, in most instances, when the prospective mother has become emaciated through nausea, starvation and usually an unbalanced diet, the maternal milk must be lacking in proper balance. Commenting on

Fig. 3.—Typical case of mongolism. The standing position is due to a rachitic condition. (After William Duke.)

the prophylaxis of mental deficiency in children, Sajous[1] states:

The continuation of prophylactic treatment through the maternal milk after birth will do more than approximately restore the developmental balances, physical and psychic, of the child; it will serve to protect it against disease. Indeed, the milk of a normal woman does more than feed her suckling; it is now known to protect the infant against infection by means of ferments which correspond in their physicochemical properties with those of the ductless glands. In a mentally defective woman, however, the probability (shown by autopsies) that one or more glands may be defective gives her milk a doubtful character; hence the need of continuing the use of organic products. Cow's milk contains all the defensive ferments referred to, but, unless it can be administered absolutely fresh, its protective properties disappear, the milk then becoming an excellent culture medium for pathogenic organisms. Cow's or goat's milk fed to the infant immediately after being drawn from the udder, and not pasteurized—since this measure destroys some of the ferments—will alone sustain the effects of the treatment begun *in utero*. Even under these conditions, however, the use of organic products with the milk is advisable, the tendency of all children thus treated being to recede

Fig. 4.—Mongolian idiot with normal younger sister. (After Sajous.)

unless this is done, at least until their own ductless glands acquire sufficient power to carry on their functions normally. The results in these little patients, especially when, as is the case in most instances, the predominant stigmata are of thyroid origin, are sometimes surprising.

ARTIFICIAL FEEDING

There is no doubt that the various types of artificial foods have had their part in producing the deficiencies with which we are dealing. It is hard to keep up with the many claims that are made by those producing these substitutes. We know that they are greatly improved over some of the old prepara-

1. Sajous, C. E.: Internal Secretions and Principles of Medicine, Vol. 1, Philadelphia: F. A. Davis Co., 1922.

tions that were chiefly fat producing, but I cannot help feeling that if we get far from the mother's milk, we will err greatly.

UNBALANCED DIET

The importance of a balanced diet as regards teeth and bone structure scarcely need be emphasized here, but we must consider other factors in conjunction with diet, which I will stress later. I would refer you to such authorities as McCollum, Sansum, Sippy, Howe and Marshall, and to an article "Your Weight and How to Control It," sponsored by the American Medical Association.

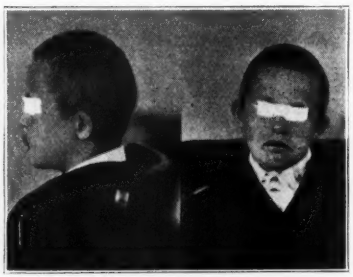

Fig. 5.—Mongolian idiot with I. Q. slightly above average for this type.

ENDOCRINES

Possibly most important and least considered from a dental standpoint, and likewise the medical, are the endocrines or ductless glands. Referring to the thyroid, thymus and suprarenals in mental diseases, Telford Smith says:

> The thyroid gland of the mother increases during pregnancy and remains enlarged during lactation, showing that it is connected with foetal development.

Sajous says:

> The adrenals are also known to be enlarged and overactive. Neu, moreover, found that the proportion of adrenalin in the blood corresponded quantitatively with the activity of the gestative process, including the period of pregnancy. As to the pituitary, it is found to be overactive during pregnancy by Comte Launois and Mulon and others. Swale Vincent states, in fact, that it may enlarge to two or three times its normal size. That the thymus is concerned with the development of the offspring both during uterine life and after birth needs hardly to be emphasized. We now know that its influence bears mainly upon the osseous and cerebrospinal systems.

The product of the first nine milkings, called colostrum, is supposed to contain substance furnished by the ductless glands. This accounts for the stockman being so particular about the calf receiving the yield of the first nine milkings and fresh milk thereafter for some time.

Fig. 6.—Fifteenth child, with all mongoloid stigmata, but to a less degree than in the mongolian idiot shown in Figure 4. The I. Q. was also slightly higher.

Various types of monstrosity are produced by glandular deficiency or overactivity, but those we shall consider here are types manifested in dwarfs such as mongolian idiots, cretins, and nanoids. These conditions are the results of a minus state, whereas, acromegaly is a plus condition. The former are diseases of infancy and can be directly traced to a definite glandular disturbance. But while this is true, there is such a closely correlated action between the various glands that it is

difficult to isolate their functions definitely and entirely.

In referring to basal metabolism, Cushing[2] states:

For our present purposes it may suffice to say that, whether or not the increased metabolism in acromegaly is primarily of hypophyseal (which we believe it to be) or primarily of thyroid origin, it can be as definitely lowered by a partial hypophysectomy as by a partial thyroidectomy.

Referring to the removal of the thymus gland in young animals:

Klose and Vogt[3] operated on twenty-five dogs. The phenomena observed are briefly as follows: After the latent stage of about

Fig. 7.—Effect of thyroid extract therapy in cretin, aged 7 (left), whose development had ceased at 3 years. Right: Patient after one year's treatment (growth, 6½ inches).

fourteen days the animals gradually showed a spongy, soft skin, a "pasty habitus." They began to remain behind in growth on account of a lessened growth in length of the extremities. The bones were distinctly more flexible. In agreement with Basch,[4] Klose and Vogt found that the ossification is retarded and that if the bones are fractured callus formation is very poor or does not occur at all. The ash content of the bones is essentially diminished. Basch also found that in this stage the elimination of calcium is essentially increased.

According to Ranzi and Tandler,[5] the dentition is also delayed in this stage; the dogs take on abundant fat (stadium adipositatis, according to Klose and Vogt). This is followed by a stadium cachecticum; in spite of increased hunger the animals gradually lose weight, muscular tremors occur.

DISEASE

Diseases, especially so-called contagious conditions, are responsible for more of our human ills than we attribute to them. Following in the wake

Fig. 8.—Myxedematous cretins of somewhat higher than average mentality for this type. (After Falta and Meyer.)

of these are such diseases as: rachitis; sinusitis; tonsillitis, and tumerous and hypertrophied conditions of the mucosa of the nose including enlargement of the adenoids, but this, like the others, must be linked up with other conditions.

DECAYED TEETH

Soreness and aching of the teeth may be the cause, in many instances, of a lack of proper mastication, frequently causing the patient to avoid chewing; which hastens further decay, and interferes

2. Cushing, Harvey: Acromegaly from Surgical Standpoint, Brit. M. J., 2:1-9 (July 2); 48-55 (July 9) 1927.

3. Klose and Vogt: Klinik und Biologie der Thymusdruse, Tubinger, 1910.

4. Basch: Die Beziehung der Thymus zum Nervensystem, Jahrb. f. Kinderh., 58, 1908.

5. Ranzi and Tandler: Ueber Thymusexstirpation, Wien. klin. Wchnschr., 27, 1909.

with muscle development, affecting the digestion, both by incorporation of decayed matter in the food and lack of insalivation. Last but not least is the fact that all this causes a lessened desire for food.

LOSS OF TEETH

There is no doubt that the premature loss of deciduous and the sacrifice of permanent teeth are a decided factor in malformation of dental arches as well as of the nose and other associated organs, but again the question arises as to which is cause and which is effect. Doubtless, we again have the biologic deficiency, producing a pathologic condition which, in turn, causes the loss of teeth and in turn, deficient mastication.

Fig. 9.—Left: Appearance of patient before acromegaly set in. Right: Acromegalic changes indicated by thick lips, heavy jaw and pawlike hands. (H. I. Goldstein's case.) (After Falta and Meyer.)

MUSCULAR DEFICIENCY

We cannot overlook the important rôle that muscle functioning plays in the development of the cranium. Most of the cases heretofore mentioned can be regarded as contributing to its deficiency. A fact too generally overlooked is that, in rickets, the bone is not the only tissue that suffers, but we have rachitic or weak muscles with which to deal, and there must be a proper muscle tone before results can be expected from this source.

PUBESCENT PERIOD

If the child has been subject to most of the heretofore mentioned maladies, it is reasonable to expect that he will have a disturbed adolescence. In many instances, when puberty and rapid growth are simultaneous, a halisteresis, a lack of a sufficient amount of lime salts (evidenced by what is commonly called growing pains), ensues. Hammer states that the thymus weighs 5 gm. at birth and 25 at puberty, and diminishes to 5 gm. at 21 years of age. My observations of young cattle prove that the well nourished calf, the one that receives a sufficient amount of milk, has a large thymus (sweetbreads), whereas the

Fig. 10.—Typical progressive case of acromegaly, with anterior excursion of lower teeth. (After Howard.)

poorly nourished animal has a deficient gland. According to Sajous: "The function of the thymus is to supply, through the agency of its lymphocytes, the excess of phosphorus in organic combination which the body, particularly the osseous, nervous, and genital systems, requires during its development and growth, i.e., during infancy, childhood and adolescence or later if need be."

It is well known that the parathyroids have to do with the calcium

metabolism. Phosphate and calcium being the chief constituents of bone and other tissue as well, it can readily be seen how their impairment affects the metabolic process. All this results in too heavy a drain on the glands and the mineral supply. Consequently, they cannot supply the bones with sufficient mineral elements. Owing to this lack of sufficient minerals, the joints give way, pain resulting. Thus, both the generative process and osseous development suffer. I am convinced that, in most of the pubescent cases, with faulty metabolism and possibly glandular deficiency, we would do well to discontinue treatment during this period. Again, referring to the stockman: A well-regulated racing stable does not run a pubescent animal, knowing this would jeopardize its future prospects.

The previous statements are but a very brief résumé of various phases. We have a vicious circle with which to deal. The metabolic disturbance causes decay of the teeth, this decay causes improper mastication and impaired appetite. These, in turn, interfere with the metabolic process, which interferes with muscular development and retards bone growth. A lack of bone growth interferes with the respiratory function.

I repeat: "Biology is the science of living organisms, and of their structure, life, growth and actions." The subject allows a wide latitude, of which I have taken advantage. The accompanying illustrations show cases of glandular deficiencies and suggest that we have many potential cases resembling these various types.

The ductless glands definitely affect structure, life, growth and action; for we are what our ductless glands are. While treatment with the extract from the thyroid gland is the only one that has met with any degree of success when used in a commercial form, some of the accompanying illustrations demonstrate possibilities of organotherapy with the fresh form of pituitary extract. Doubtless, we shall some day find a method of preserving their potency in a commercial form as has been done of the thyroid. While it is important now that dentists know of the function of these glands, it will be doubly so if all of these extracts become useful commercially.

If there are ever any definite data established in this special field, it must come from our group, and to such pioneers as C. C. Howard,[6] we owe a debt of gratitude.

In Figure 1, the large female rat on the right was born Oct. 28, 1925, of thoroughbred stock. Jan. 21, 1926, when it weighed 163 gm., intraperitoneal injections of a neutral filtered aqueous extract of anterior lobe beef hypophysis in amounts equivalent to about one-tenth of a beef gland daily were begun. The roentgenogram was taken Aug. 5, 1926, at which time it weighed 500 gm.

The small (control) rat on the left, a female of the same stock, was born Nov. 2, 1925. Jan. 21, 1926, it weighed 165 gm. It was given injections of commercial anterior lobe extract, which proved to be without effect. At the time the

6. Howard, C. C.: Résumé of Four Years of Study at Good Samaritan (Endocrine) Clinic with Special Reference to Seven Hundred X-Ray Hand Pictures and Their Relation to General Bone Progress, Internat. J. Orthodon., 14:434-438 (Feb.) 1928. Physiologic Progress of Bone Centers of Hands of Normal Children Between Ages of Five and Sixteen Inclusive; Also Comparative Study of Both Retarded and Accelerated Hand Growth in Children Whose General Skeletal Growth Is Similarly Affected, ibid., 14:948-998 (Nov.), 1041-1067 (Dec.) 1928. Phase of Skeletal Growth as Influenced by Sex Hormones, ibid., 18:659-666 (July) 1931.

roentgenogram was taken, the animal weighed 260 gm. (Harvey Cushing.)

Figure 2 shows two litter-mates, brothers, born Oct. 22, 1925. The animal on the right, then slightly the larger of the pair, was hypophysectomized November 27. Three months later (Feb. 24, 1926), the control weighed 338 gm. and the hypophysectomized animal, 108 gm. (Though 4 months of age this animal had never mated.) At this time, just before the photograph (left) was taken, the left testis has been removed from each of the animals. The organs are shown. The dwarfed and sexually undeveloped animal was then given each day a homoplastic hypophyseal transplant, and April 20 he mated with a female in oestrus and a litter resulted. Daily pituitary transplants were continued until the hypophysectomized animal had almost caught up in weight (258 gm.) with its control (385 gm.). May 9, when the photograph (right) was taken, the pair were killed and the remaining testis of each is shown in the figure. (After Cushing.)

I shall attempt to differentiate between the mongolian idiot and other types of dwarfs and mental deficients. While they are closely related in some respects to the cretin, many of their stigmata are decidedly different. (Falta and Meyer[7] [pages 505-506] present an excellent comparative chart differentiating the two.) According to many authorities, some herein quoted, the thymus gland is especially affected in these cases. These children are usually the last born in a large family with many healthy and brilliant children preceding them. My findings have been substantiated by Leeper. For example, in his study, he found that one-half of 176 mongolian idiots were the last-born of large families, and that neuroses were common among their ancestors. I found one case in a boy in Randal's Island, New York, who had five older brothers who were holding very important positions. This patient was a typical mongolian with I.Q. not exceeding 4 years. Sajous states: "To use a homely comparison, the factory is worn out 'in toto' or in part, and the product is below par. This is illustrated by the characteristic facies of the mongolian child." There are many observers who hold opposite views in regard to the function and development of the thymus and it is true that there is great variance in size, but I fear there has not been enough account taken of the infant feeding of the child or animal as is substantiated by my findings in calves. The mongolian is usually rachitic, subject to all sorts of diseases and frequently dies young of some contagious disease. These children present a great number of stigmata. I shall emphasize those that are interesting from a dental standpoint: slanting eyes; low nose (bony portion); a maxillary arch which is nearly always exceedingly small, usually with a congenital absence of maxillary teeth (the mandible is nearly normal); a pot bellied appearance; pitted tongue, one that nearly all endocrinologists term the tongue lying between the upper row of teeth. They apparently give no thought as to why this condition exists. According to my observations, they do so to prevent the lower from closing labially from the upper; in other words, for the convenience of rest. In fact, various authorities say the same of both mongolians and acromegaliacs: namely, that the lower teeth close over the upper;

7. Falta, Wilhelm, and Meyer, M. K.: Endocrine Diseases, Ed. 3, Philadelphia: P. Blakiston's Son & Co., 1923.

whereas, in the former, there is a very broad maxilla and, in the latter, an overdeveloped mandible accounts for the condition. It is true that the mandibular teeth close over the maxillary in both instances. These all show a decided osseous, genital and mental deficiency. If organotherapy has not improved their condition, which it seldom does. Orthodontic treatment is contraindicated owing to the rachitic condition.

Figure 3 shows a typical case of mongolism. Note particularly the short stature, slanting eyes, open mouth, large abdomen and the standing position (legs spread apart) due to a rachitic condition.

Figure 4 shows an exception to the rule, a normal sister following a mongolian idiot. This is more commonly found in cases of disease in parents rather than overworked reproductive organs.

Figure 6 shows a fifteenth child, with all the mongoloid stigmata but to a less marked degree, including a slightly higher I.Q.

In Figure 5, the I.Q. was slightly above that of average mongolian, but was questionable because of an inferiority complex and the fact that the parents were of foreign birth.

In the cretin, the gland that is especially deficient is the thyroid. The cretin is short in stature, has somewhat of a "squatty" nose, is pot bellied and has not particularly slanting eyes, a narrow arch and high vault and teeth crowded and soft. These defectives are rachitic and of low grade mentally, but they can usually be successfully treated with commercial thyroid extract. They are myxedematous, but the condition clears up readily after treatment is started. If organotherapy treatment has succeeded in building the child to nearly normal, it is reasonably safe to begin orthodontic treatment, but constantly bearing in mind that possibly he will not lose all the characteristic stigmata incident to this type and that we are dealing with a defective tooth structure.

Figure 7 illustrates the effect of thyroid extract therapy in cretinism (J. B. McGee.) At the left is a cretin, 7 years old, who ceased to develop when 3 years old. At the right, changes after one year's treatment are evident (growth, 6½ inches). (After Sajous.)

Figure 8 (after Falta and Meyer) shows myxedematous cretins of a somewhat higher mentality.

While the acromegalic shows a plus condition and presents an overdeveloped mandible, this is of no less importance and should be carefully diagnosed and prognosed. While there are few cases that can be arrested even by a partial hypophysectomy, we should at least realize the possibilities. Acromegaly is usually caused by a hyperpituitary condition. This is true likewise of giantism, but the differentiation has not been satisfactorily explained. That is, in true giantism, the dental arches are harmonious; whereas, in acromegaly, the mandible is greatly overdevoloped. In advanced acromegaly, no attempt should be made at orthodontic treatment, but there are doubtless thousands of potential cases that can and are being fairly successfully treated, but with a lack of proper knowledge of the condition in hand. It is my object to lead you to observe more closely the patients with whom we are dealing and to realize that all people are not of the same pattern. That is why ours is not an exact science, as some of our mechanical efforts might lead us to assume.

Figure 9 (left) shows a patient before acromegalic changes occurred. The photograph on the right shows the acromegalic face, the thick lips, heavy jaw and long hands of the paw-like type. (H. I. Goldstein's case of acromegaly and lymphatic leukemia. Note hairiness is not marked. (After Falta and Meyer.)

Figure 10 shows a typical progressive case of acromegaly, with anterior excursion of the mandibular teeth.

DISCUSSION

Sidney W. Bradley, Ottawa, Canada: This material applies to the everyday practice of orthodontia. I shall try to emphasize the salient points which appeal to me as an orthodontist. Slides that I have made of cases in my own practice show just how essential a knowledge of human biology is to the intelligent diagnosis of our cases. We orthodontists believe that bony growth may be produced by the mechanical stimulation of appliances, but we know that it can be only as successful and permanent as are the health and response of the tissues on which we work. We know that to get the best results in the shortest time the child must be healthy and properly nourished. Those children that are poorly fed (and we find them in all grades of society, nearly as many among the very wealthy as among the very poor), the rachitic, those suffering from nasal stenosis and throat affections and those with unbalanced glandular functions are not healthy, and the results will be only in proportion to our success in overcoming these deficiencies and correcting the underlying abnormalities. The effects of obscure retardation on physical development may be seen all through the child's life until, when maturity is reached, the child's stature is below what it should be if proper attention had been given to diet, with care of the breathing apparatus and due regard to glandular stabilization. There is the intrinsic structural factor also to be considered in the growth, development and maintenance of healthy tooth structure. Good food, fruits, raw and cooked vegetables, fresh wholesome milk and cereals which require mastication, but without an excess of sugar, must be used, with plenty of exercise in the sunshine and pure air if the muscles, teeth and underlying bony structures are to be properly developed. Dr. Robison merely mentioned the artificial prepared foods. A few of them may have some merit, but surely we can find plain foods of which we know exactly the constituents, made up freshly as required without resorting to prepared products. There must be a sufficient supply of calcium phosphate and other necessary bone-building elements. In this way, we can have good strong teeth with healthy surrounding tissues which will respond to stimulation and muscular guidance. There is no doubt that orthodontic stimulation of the jaws and surrounding bony and muscular tissue aids the whole development of the child. Even when the patient lacks proper diet and care in other ways, we often see a fine development, perhaps later than it normally would occur, but it comes, and, in some cases is, I believe, due to orthodontic procedures. The correct appliance for the case under consideration is vitally important. Certain appliances will be biologically and physiologically correct for one case, but not for another. There is no universal type of appliance. There is a best appliance for the individual case. Let us not marry any one type, be it plain round alinement wire with ligatures, a pin and tube appliance, a lingual appliance with auxiliary springs, or ribbon arch or edgewise alinement wire. Let us use whichever type we decide on as being the best, but remember that the type which may be good for the mandibular teeth may not be indicated for use on the maxillary. Dr. Robison spoke of preconception disease, such as syphilis and tuberculosis, in parents, and the difficulty there is in learning of this from them. My experience, and I am sure it is much the same with all of you, is similar to his. We cannot get the history we should like to have and must carry on as best we can with the information secured at the early consultations. This is the time to realize our limitations and not undertake the impossible. Enthusiasm will overcome many difficulties, but it is best when tempered with knowledge and experience. Dr. Robison has told us about many underlying conditions which we must consider before starting our cases, or we may begin something which is beyond our ability to treat successfully and beyond mechanical therapy. Dr. Robison speaks of

the careful diet necessary for the prospective mother, and how the stock raiser takes great care of his animals which are gravid, but fails to realize that his wife should have the same care during pregnancy. He also mentions the importance of mother's milk for the child and its protective properties against disease during lactation. Perhaps modern civilization may advance to the stage that when it is impossible for the mother to feed the child, we may have goat's milk when we want it by having the source of supply in the back yard or even on the front lawns if necessary. That suggestion may appear amusing, but I am serious when I make it. I liked Dr. Robison's explanation of growing pains. The parathyroids have to do with calcium metabolism. When their function is impaired, the metabolic processes are affected and there is too little mineral substance available to the organism. As a result, the bone joints lack sufficient mineral substance and pain results. Dr. Robison also advises that in cases of marked faulty metabolism and possible glandular deficiency during pubescence, treatment should be discontinued. He again refers us to the stock raiser for substantiation of his conclusions. We have all noticed periods during treatment when the movements of the teeth and the development that we are working for are progressive. We have also seen those periods when, in spite of all we do, there is no progress. During those static periods, we might just as well remove the appliances, or at least have them passive until we feel that we can again accomplish some further progress. This all means that we must recognize abnormal systemic conditions and work in conjunction with the family physician, pediatrician and endocrinologist when if we are to have the best results and surely by our combined efforts and sympathetic cooperation from the parents, we should be able to start our young patients in the struggles of life with healthier bodies and better mental faculties when it is possible to develop them.

THE PROPER TIME TO START ORTHODONTIC TREATMENT*

By SAMUEL J. LEWIS, D.D.S., Detroit, Mich.

ONE of the most perplexing problems confronting the orthodontist is that of determining whether the institution of orthodontic procedure is advisable in any given case. Milo Hellman has given us one answer to the question in his statement, "Orthodontic procedure should be instituted when it will do the most good and be of undoubted benefit to the individual." Although this theory is a sound one, and one expressing my convictions, further consideration seems necessary if we are to arrive at a logical basis for determining exactly when the treatment of dental irregularities or malocclusion of the teeth is desirable.

Malocclusion is of itself a relative term. Its conception is based on the assumption that normal occlusion represents that condition in which thirty-two teeth are alined in their respective arches and in perfect relation to each other. By definition, then, any departure from this ideal scheme would constitute malocclusion. We know, however, that perfection is not the rule in Nature and that some variations in the occlusion of the teeth may fall within the normal range. Thus, Hell-

*Read before the Section on Orthodontia at the Seventy-Fourth Annual Session of the American Dental Association, Buffalo, N. Y., Sept. 13, 1932.

man found in his study of many cases of so-called perfect occlusion that the average degree of perfection was only 90 per cent, with a standard deviation of plus or minus 6 per cent. In other words, basing his findings on the relation of such functional points as cusps, fossae, ridges, surfaces and embrasures, and using 100 per cent to represent a condition in which these relationships approached perfection, Hellman found the normal range of variation to be from 84 to 96 per cent. With some reservations, we may then accept his conclusion that within this range is found the type of occlusion in man. And we may designate any occlusion falling within this range of variation normal occlusion.

Applying this yardstick in our diagnosis, we can discover whether a particular case falls within or without the range of normal variation. Thus, we can make a decision as to whether the case in question presents a condition that interferes with normal functional activity, i.e., is atypical of the occlusion of man. If it does interfere, orthodontic procedure should be instituted; if it does not, judgment must be exercised in determining whether treatment will be of undoubted benefit to the individual. This applies more particularly to the early adult dentition. In a measure, it may be applied to the completed deciduous dentition. It must be apparent that, although the diagnosis of malocclusion in the deciduous denture may be identical with that in the permanent denture, the treatment may not be the same. Figure 1 illustrates this point. A condition is shown in the deciduous denture which, if seen in the permanent one, would indicate immediate treatment. In this case, the malocclusion, which was caused by thumb-sucking, corrected itself as soon as the habit was broken. The same thing is true of open bite cases of some types, especially those in which certain sucking habits are present.

Many times, conditions are found in localized areas in both the deciduous and early adult dentures which, although they may fall within the normal occlusal range when considered as a whole, may interfere with function to such an extent, or so reduce the esthetic values of the face that immediate treatment becomes necessary. Figure 2 shows such a condition. In these cases, there is a reversal of normal development, and treatment will reestablish normal function, which is necessary if development is to proceed normally. Thus, whether these conditions are found in the deciduous, mixed or early adult dentition, orthodontic procedure will be of undoubted benefit.

Fig. 1.—Malocclusion from thumb-sucking corrected spontaneously after habit was broken.

Now let us consider for a moment three types of malocclusion, found in all types of dentures. These types include Class II and III (Angle classification) and an atypical Class III condition, more correctly called a microdevelopment of the premaxillary area. Since all Class III cases constitute a reversal of normal development, they should be treated early, regardless of the etiologic factors. Correction of the relation between the dental arches in this type of malocclusion is comparatively simple in the deciduous denture, and the correction often carries over into the permanent one. Figure 3 shows a case of this description. It took only three and a half months to correct this case. While the atypical condition is similar in appearance to the typical Class

III type, diagnosis and treatment are not the same. Figure 4 will serve to illustrate this point. You will note that the relation between the dental arches is normal and that the molars occlude properly. show the later results with no further treatment. Immediate treatment is indicated in these cases, regardless of the age.

Whether orthodontic procedure should be instituted in Class II cases is a moot

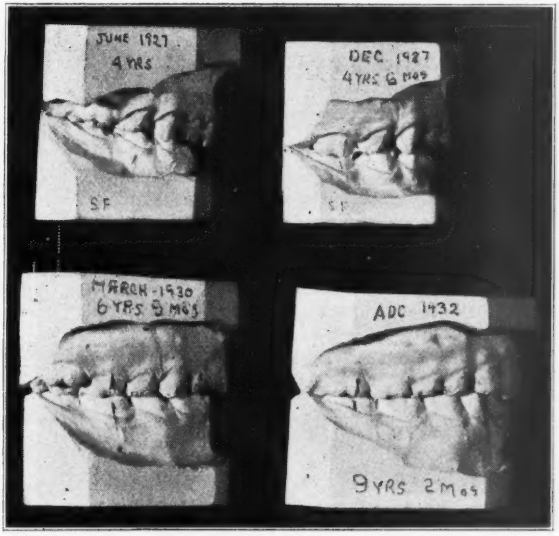

Fig. 2.—Case showing need for early correction. The first permanent molars are erupted out of occlusion. This condition was corrected later by connecting molar bands with a small intermaxillary elastic.

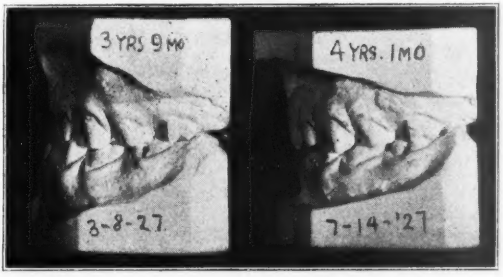

Fig. 3.—Class III case corrected in deciduous denture in three and a half months.

The only treatment necessary was to move the upper incisors labially to occlude over the lower ones. The succeeding models, made by the child's father, question in the minds of experienced orthodontists and scientific investigators. To a questionnaire sent out a few years ago, the large majority of operators re-

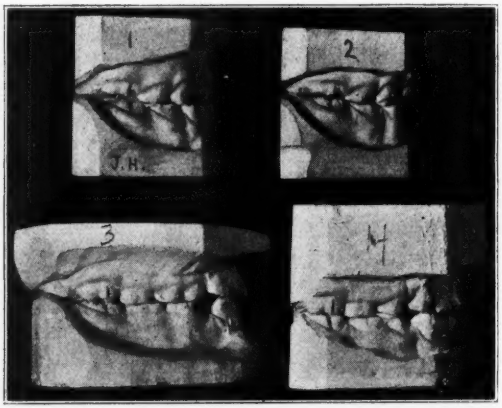

Fig. 4.—Atypical Class III case showing results of early correction. No care was needed after the primary treatment.

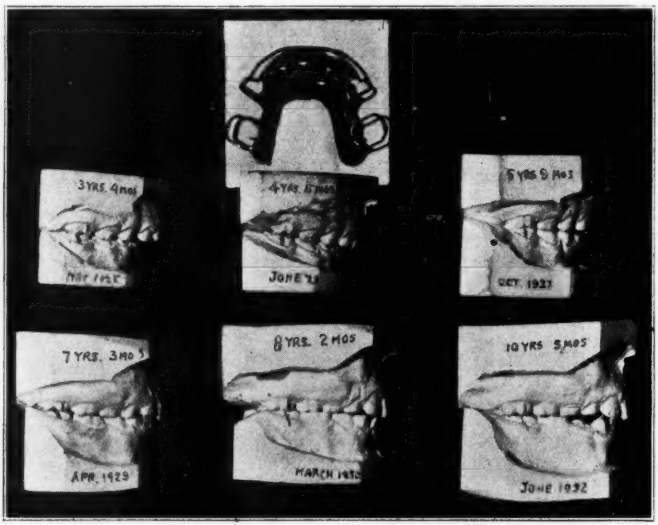

Fig. 5.—Class II case of first type in which Hawley plate was utilized in holding mandible forward. This case was observed before this form of treatment was utilized.

plied that when Class II cases were treated in the deciduous denture, they always had to be retreated later. Undoubtedly, these cases, especially those belonging to division 1, present a malocclusion. They not only interfere with normal functional activity, but also detract from the esthetic values of the face. In

the observations which we have been making for the past nine years at the Merrill-Palmer School, in Detroit, spontaneous correction of a Class II, division 1 case has never occurred. These cases usually become worse. The problem which they present is determination of the proper time to institute orthodontic procedure. If the condition is corrected at 3 or 4 years of age, a normal relation between the arches may be established. Since the cusps of the deciduous molars start showing signs of wear after 6 years of age, it may be difficult to retain this relation without some form of appliance. On the other hand, if the condition is not corrected early, proper mastication may be interfered with and the face may become

Fig. 6.—Class II case in which there is an underdeveloped mandible. Trimming the teeth will not allow the mandible to assume its normal anteroposterior relation. Treatment is indicated in these cases.

deformed to such an extent that no later treatment will entirely repair the damage. After study of these cases in the routine of my observations at the Merrill-Palmer School, I have for the present divided them into two categories: those that present a slight narrowing of the maxillary arch and those that involve a lack of development in the mandible itself. In the first type (Figure 5), a little trimming of the cusps of the cuspids is usually all that is necessary to establish a condition of mechanical advantage. Muscle exercises or the use of a Hawley plate will usually complete the case. You will note, in this type, that when the mandible is brought forward, the teeth are in good occlusion.

The second type of Class II, division 1 cases, those involving lack of development of the mandible itself, or rather an apparent lack of development, is illustrated by Figure 6. The maxillary arch is narrow and the mandible seems very much underdeveloped. If one were to try to fit these models together, a normal relation could not be established as this figure shows, even though the cusps have been trimmed or the maxillary arch widened somewhat. There seems to be some discrepancy in the mandible. Either the lower incisors are in supraclusion or the molars in infraclusion. The only effective treatment seems to be a change in the occlusion of the mandibular teeth; that is, a change in the curve of Spee, together with widening of the maxillary arch. Early treatment of this type of case is justified.

In Class II, division 2 malocclusion, characterized by a bilateral or unilateral distoclusion, with a deep anterior overbite, there is more of a question as to when orthodontic procedure should be instituted. The facial features are often not involved, and there seems to be a tendency for the deep anterior overbite to correct itself, to some degree at least, after the permanent incisors have erupted. Experience has often proved that raising the bite with appliances in these cases is effective only temporarily. The final result was a depression of the deciduous molars in their sockets. I am free to admit that these cases are puzzling at times and that the time to treat them has not yet been satisfactorily determined. Figure 7 may throw some light on the problem. In this case, there was a deep anterior overbite with a unilateral distoclusion (right side). Models were made at the begin-

ning and the case observed for about two years. In the second model, as may be seen, the original distoclusion persists and the first permanent molars are in distoclusion also. At this point, the diagnosis was made, and it was decided that orthodontic procedure would be of undoubted benefit.

There seems to be some difference of opinion among orthodontists with reference to early treatment in the deciduous denture in cases presenting irregularities in the incisor region, and especially those cases which show a lack of what is sometimes called developmental spaces in the

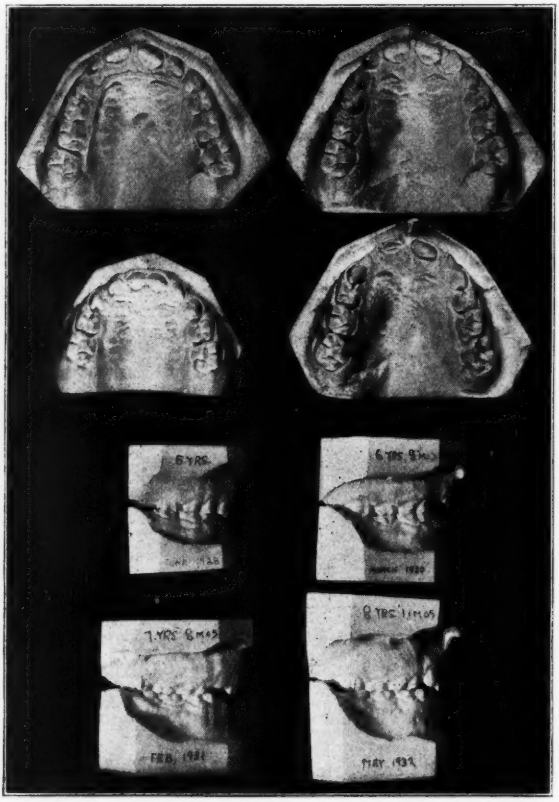

Fig. 7.—Class II, division 2 case in which all treatment needed was rotation of maxillary first permanent molar. No intermaxillary elastics were worn.

The maxillary first permanent molar had erupted in a rotated position. This was taken care of, with the result that the distoclusion corrected itself spontaneously. The anterior overbite, as may be seen, is in the process of opening.

incisor region. It has been said that if irregularity in the deciduous denture is corrected, a recurrence in the permanent one will be prevented. Now, what is the truth about this problem? Since 1923, we have been making yearly impressions

and examinations of a rather large group of preschool children at the Merrill-Palmer School, in Detroit. As none of these children are undergoing orthodontic treatment, we are able to observe natural developmental changes, allowing us to study quantitatively the relation between variations. For instance, in a certain number of deciduous dentures that present irregularly alined incisors, we can determine just what happens after the permanent incisors erupt. In a certain number of cases showing varied conditions with reference to this so-called developmental spacing in the incisor region, we can study the relation between this spacing and the alinement of the permanent incisors; and so on almost to infinity. Many of these studies have been made and the results published in several dental and orthodontic journals. It will suffice at this time to say that we have found no evidence to support the view that if developmental spaces do not occur at 5 years, the dental arches should be widened to receive the incoming permanent incisors. (Fig. 8.) All sorts of conditions exist; that is, cases with wide spaces often have irregularly placed incisors, while those with little or none often have regularly alined permanent incisors. We found little evidence that spacing occurred during growth. If there was spacing, it usually was present in the deciduous denture from the beginning. The important thing seemed to be not spacing, but occlusal adjustment during development. The same holds true with reference to malalined deciduous incisors. Sometimes the alinement of the permanent incisors was a counterpart of that of the deciduous. Sometimes, it was the reverse; sometimes, it was entirely changed. Since, on examination, the coefficient of correlation between these various phenomena is found so small, we can

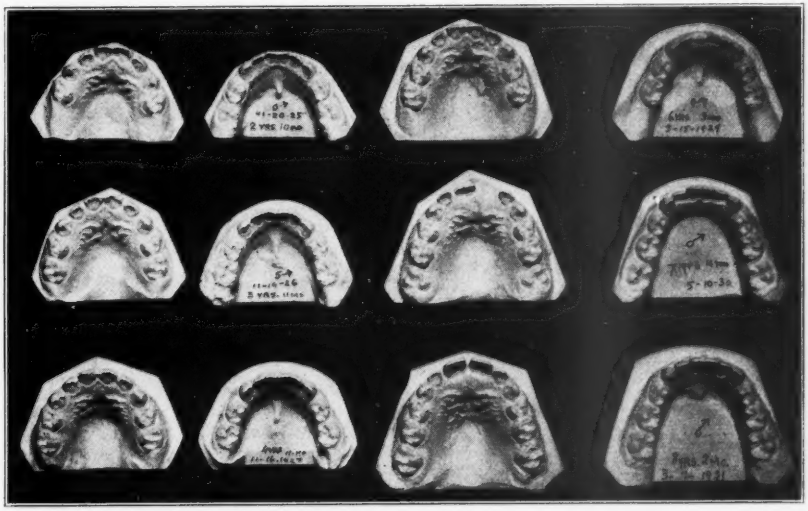

Fig. 8.—Lower incisors in alinement and without developmental spaces; rotated upper lateral incisors with good spacing.

safely conclude that there is practically no relation between these conditions at all and, therefore, from the evidence in hand, that early treatment of these conditions in the deciduous denture may safely be postponed until such time as we can determine just what Nature will do.

This brings me to a consideration of conditions presented in the mixed or preadolescent denture. Here, we are entering on one of the phases of most rapid change in the growth history of the individual. Teeth are being shed and erupted and the jaws, face and dental arches are undergoing rapid development. Some of the changes which are taking place obscure the assumed ideal of normal occlusion, and the resulting condition may be classified as aberrant or abnormal. This misconception has befogged the issue as to whether treatment during this period is necessary. If we were to examine a large group of children at the age of 4 years, we would find a rather small incidence of malocclusion. If we were to examine a similar group at the age of, say 9 years, the incidence of malocclusion would increase suddenly. A third examination of a group at 12 years of age would show a perceptible decrease in the incidence of malocclusion. The question, then, is this: Are all the cases which appeared abnormal at 8 and 9 years, a malocclusion, or have we classified developmental variation as malocclusion? We know that occlusion is not a stable thing, and that it is the result of many of the conditions which influence and control the growth and development of the whole body. Figure 9, showing successive models of the teeth of a child, will demonstrate the changes that occur during growth. The deciduous molars are in perfect relation to each other, but the permanent molars, after their eruption, are in end-to-end occlusion. Later, as wear takes place on the deciduous cuspids and molars, the man-

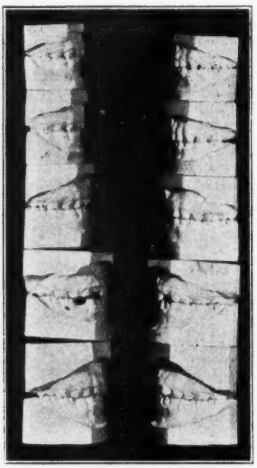

Fig. 9.—Occlusal adjustment during growth. The end-to-end relation of the permanent molars in the center models and the normal relation in the last two models may be noted.

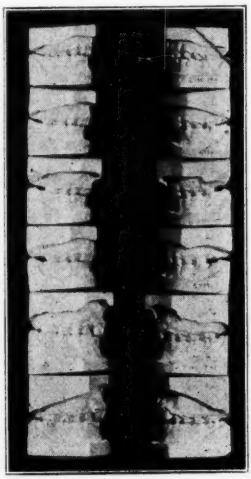

Fig. 10.—Lack of molar adjustment, but with partial correction in anterior overbite.

dible slides forward and the permanent molars assume their normal occlusal position. This change, we have found, might take place any time between 6 and 9 years of age; hence, its failure to appear during this period cannot be used as an indication of malocclusion. Before orthodontic procedure is instituted, these cases should be observed until it can be determined that the molar adjustment is not taking place. If, after observation of sufficient duration, it is determined that malocclusion. Sometimes, teeth move into normal alinement during development; sometimes not. From our observations, we have concluded that whenever the incisors are erupting out of normal alinement, some time should elapse before institution of orthodontic procedures. Figure 11 illustrates what is meant by such changes as we have been considering. When these developmental adjustments are not occurring and frequent examinations over a period of time seem to indi-

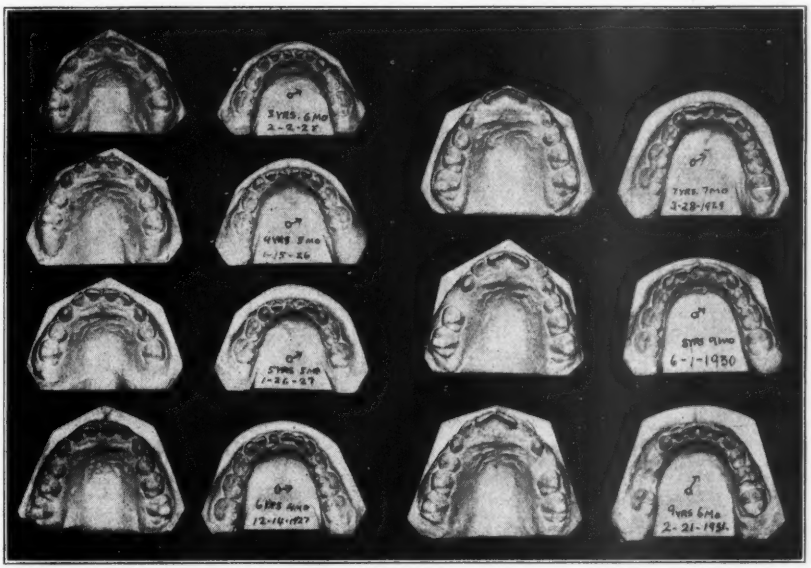

Fig. 11.—Case in which there is tendency for incisors to change positions during development.

molar adjustment is not taking place, or the condition is becoming worse, certainly treatment should be started. (Figure 10.)

What are we going to do about those cases in which the incisors are erupting out of the line of occlusion, or, if you prefer, out of line of the arch? There is a truism in orthodontia that a tooth out of alinement is not necessarily a tooth in cate no possibility that they will take place, orthodontic procedure should be instituted and not before.

Another problem that confronts us in the deciduous and mixed dentures is the problem of the abnormal *fraenum labium*. Much has been written on the subject, and mothers are often advised to have the frenum removed if there is a

space existing between the central incisors. We have been observing these phenomena, and are at present making an exhaustive study of the subject. It will be sufficient at this time to say that many so-called frenum cases are but phases in normal development which will correct themselves without interference. Figure 12 illustrates what we have observed in many cases of this kind. If the space does not close after the permanent cuspids start to erupt, or if there is a history of a similar condition in the immediate family, orthodontic procedure should be instituted. In any case, it seems wise to wait until the lateral incisors are in position before any surgical or orthodontic treatment is instituted.

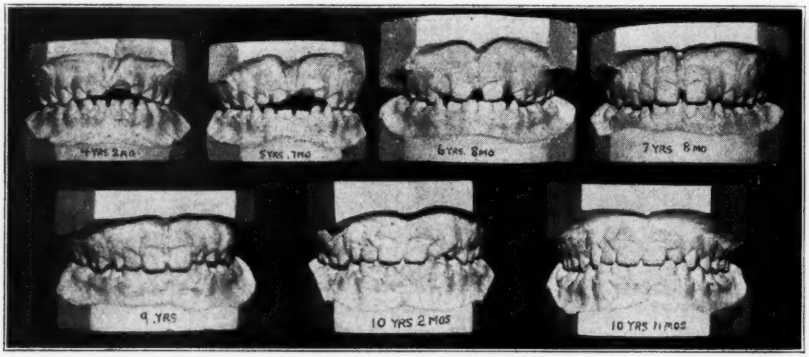

Fig. 12.—Case in which diagnosis of abnormal frenum was made. Progressive models show that this condition was a phase in normal development. As can be seen, nature corrected the condition.

I cannot leave this subject without discussing, briefly at least, the problem of the early or premature loss of the deciduous teeth. According to the teachings of some men, when a deciduous tooth is lost prematurely the teeth adjacent to the space will migrate and so cause malocclusion. Certain teachers have gone so far as to tell their students that this is the most frequent cause of malocclusion and that whenever it occurs, a space retainer should be used. If we examine the evidence in cases of this kind, we find that many things may occur. Sometimes the space closes; sometimes it remains static, and sometimes it becomes larger. In fact, spaces that have closed sometimes open up, and molars that have tipped right themselves during developmental adjustment. Figures 13-16 illustrate some observations in untreated cases. Certainly, a space retainer would have been of no value in some of these cases. In fact, it is my opinion that their use would have been harmful in some instances. I do not wish to decry the use of space retainers in well-selected cases. They are of value if correctly constructed and applied. In some cases, nothing short of an orthodontic appliance will suffice to correct or prevent an incipient malocclusion due to the premature loss of a deciduous tooth or teeth. What I am most anxious to convey to you is that, in the kind of cases under consideration, we are dealing with a developmental process and, before instituting orthodontic treatment, we should determine whether Nature is go-

ing to effect a normal adjustment. The most satisfactory procedure consists in making a set of casts at the time of the loss, following this with periodic examinations, until it is possible to determine whether the condition is changing for the worse. When it becomes evident that changes are occurring which will interfere with occlusion, it is time to institute orthodontic treatment. It is then that it will do the most good and be of undoubted benefit to the individual.

sion, I wish, in conclusion, to quote from a paper by Milo Hellman. Speaking of instituting an orthodontic procedure when it will do the most good and be of undoubted benefit to the individual, he says:

> According to this viewpoint, the orthodontist, besides correcting irregular teeth also assumes the rôle of an advisor and a guardian who may be intrusted with the supervision of the proper development of the child's dentition. Of course, considerable knowledge of the development of the face, jaws and teeth is indispensable.

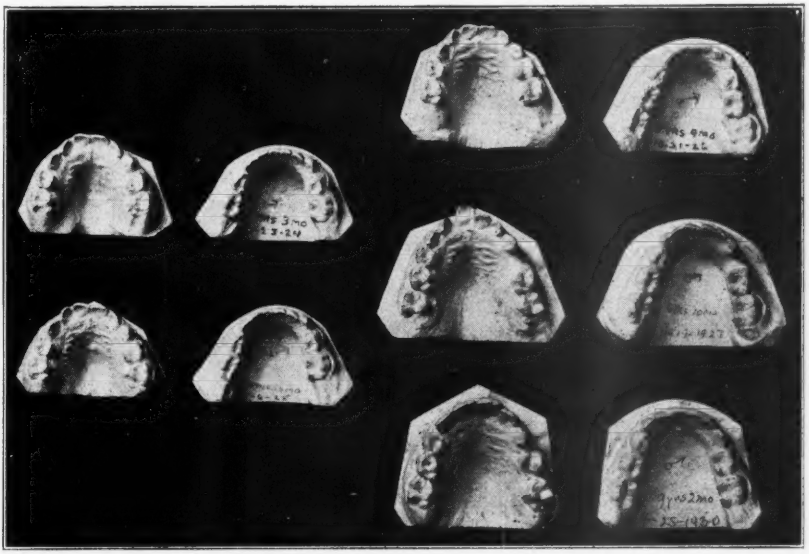

Fig. 13.—Closure of space following loss of upper right deciduous cuspid and lower left deciduous first molar. A space retainer might have accomplished some good here.

The whole subject of the proper time for the institution of orthodontic treatment is an exceedingly broad one and one that can hardly be treated exhaustively in a short paper. I have tried to cover the points which seem most essential and to treat them in a way that will be of the most practical value.

As a guide on the many tortuous paths in diagnosis and treatment of malocclusion. Equally important is the method of procedure by which the progress in development is appraised.

This, in brief, is the message that I have attempted to bring to you in my discussion.

SUMMARY

1. Malocclusion is a relative term. Its conception is based on the assumption that normal occlusion represents that con-

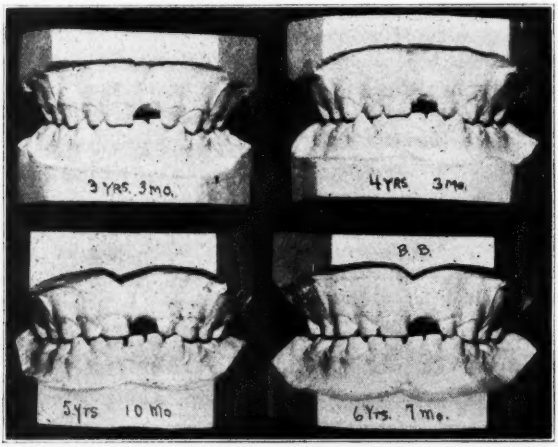

Fig. 14.—Premature loss of left upper deciduous central incisor at 3 years. The space is getting larger. No space retainer was used in this case.

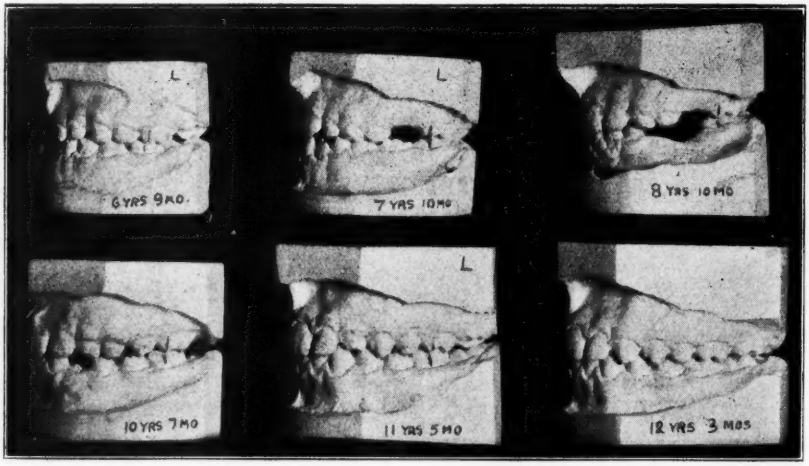

Fig. 15.—Premature loss of all lower left deciduous molars and upper second deciduous molars, followed by normal occlusion. No space retainers were worn and no orthodontic treatment was instituted.

dition in which thirty-two teeth are alined in their respective arches and in perfect relation to each other.

2. Hellman's determination of the type of occlusion in man may, with certain reservations, be used as a yardstick in diagnosing malocclusion in the early adult denture.

3. Diagnosis of malocclusion in the deciduous denture may be identical with

that in the early adult denture, but the treatment may not be the same.

4. Certain occlusal conditions found in localized areas, although they may fall within the normal occlusal range, may interfere with function to such an extent as to justify immediate treatment.

5. Class III malocclusion should be treated at an early age, regardless of the etiologic factors. The correction often is carried over into the permanent denture.

6. Atypical Class III malocclusion, characterized by a normal relation between the dental arches, but with a micro-

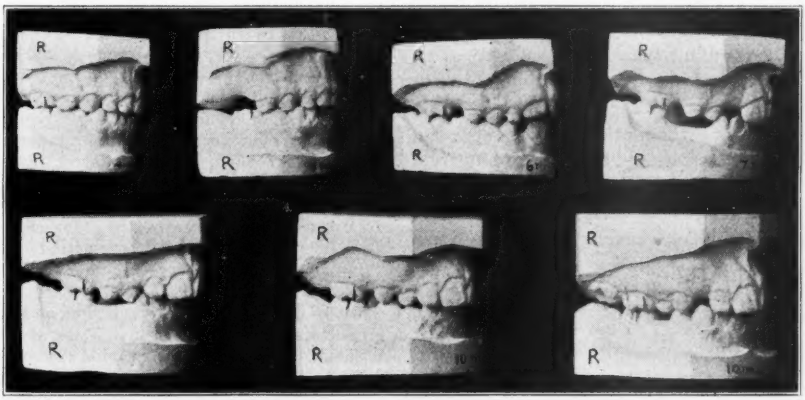

Fig. 16.—Interesting case of premature loss of deciduous teeth. The closing of the upper second bicuspid space and, later, its normal opening may be noted. The occlusion of the permanent molars in the fourth model in the upper series and again in the lower models is also to be noted. No treatment was used in this case, and no space retainers were employed. This case shows a decided tendency on the part of Nature to correct a malocclusion caused by early loss of the deciduous teeth.

development of the premaxillary area, should be treated as early as it is discovered. This treatment also is carried over into the permanent denture in most cases.

7. There is some question as to whether orthodontic treatment should be instituted in Class II, division 1 malocclusion of the deciduous dentition. Two types seem to be present; (*a*) those in which there is a slight narrowing of the maxillary arch in the cuspid region, and (*b*) those in which the maxillary arch is narrow and the mandible is underdeveloped. In the first class, a slight trimming of the cuspid tooth cusps plus some muscular exercises or the use of a bite plane, is often all the treatment necessary to establish a normal arch relation. In the second class, cusp trimming will not suffice. The occlusal plane must be altered and the mandible brought forward into its normal position.

8. In Class II, division 2 malocclu-

sion, there is more of a question as to when orthodontic treatment should be instituted. In most cases, it is better to postpone treatment until the permanent incisors have erupted.

9. Irregular alinement of the deciduous incisors and lack of so-called developmental spaces between the incisors do not as a rule constitute malocclusion *per se*. Cases presenting these conditions should

be observed over varying periods in order to determine whether we are dealing with variations in development. This procedure is also recommended in the preadolescent or mixed dentition, where certain irregularities in development may befog the true condition.

10. Some so-called abnormal frenum conditions are but phases of normal development. If they are allowed to go untreated, they often correct themselves. Orthodontic or surgical treatment should be postponed until it can be determined that Nature will not make the correction.

11. Premature loss of the deciduous teeth does not always cause malocclusion. The resultant spaces do not always close. They sometimes remain the same, and at times become larger. Before space retainers or orthodontic appliances are used, a set of casts should be made and a period of observation instituted so that the trend of development may be determined. Spaces which have closed have been known to open during development, and molars which have become tipped have righted themselves.

613 David Whitney Building.

DISCUSSION

Richard Lowy. Newark, N. J.: It is impractical to designate any definite age as the time to institute orthodontic treatment that will meet the requirement of all cases. The many and varying types or subdivisions of malocclusion found necessitate the operator's relying on his experience and judgment. A general rule has been promulgated: "When it is apparent that abnormal development of the dental arches is taking place, corrective measures should be instituted." But we must be more than mechanically minded: we must be able to differentiate between abnormal and normal development during the deciduous, transitional and permanent tooth stages. We must recognize the variations of normality in different individuals. The orthodontist who recognizes the fact that teeth are imbedded in a living tissue, bone, realizes that it is a highly organized plastic substance shaped by proper or improper stimulation. It naturally follows that normal function is of the utmost importance in the development of the dental arches. It is logical to say that with malocclusion of teeth, normal function is interfered with and normal development becomes impossible. Thus, if the deciduous teeth are in proper occlusion and function correctly, the permanent teeth have a greater chance to erupt in their correct position. For clarity, we divide the question of correct time for orthodontic treatment into three groups: (1) deciduous, (2) transitional and (3) permanent. With cooperation between the general practitioner and the specialist, preventive orthodontia is of great value. There are innumerable cases of malocclusion which may be corrected without orthodontic appliances, by correction of vicious habits, muscle exercise, grinding one or more deciduous teeth or careful observation when teeth have been removed prematurely (space retainers are not needed in all instances). On the other hand, if the mesial or distal arch relationship is abnormal, early treatment is indicated. In addition, arches which are contracted should be widened and mechanical interference removed to permit the natural growth of the face and arch. Early treatment permits ease of tooth movement, shortens the period of active treatment and gives Nature an opportunity to do better work. It should always be borne in mind that correction of deciduous teeth does not always mean proper eruption and function of the permanent teeth. It should be regarded only as an aid to Nature. It is during the transitional period that bone activity is increased, because, during this stage, bone is resorbed and rebuilt. It is during this "mixed denture" stage that we note the most rapid development. I agree with Dr. Lewis's statement that some of the changes which are taking place obscure the assumed ideal of normal occlusion and the resulting condition may be classified as aberrant or abnormal. We often forget that the permanent first molars erupt end to end and that growth causes the mandible to slide forward with the resulting normal mesiodistal relation. If for any reason this phenomenon does not occur, should orthodontic treatment be instituted? In my opinion, if only the permanent incisors have erupted and the molars are in distal relation-

ship, it is advantageous for the time being to keep the case under observation, because the roots of the deciduous cuspids and molars are absorbing, and an appliance cannot be properly attached to them. The mechanical efficiency of an appliance is reduced to such a minimum that distal movement cannot be accomplished. Therefore, why not wait until the beginning of the growth period, so that the mechanical therapy more nearly synchronizes with the material growth coincident with the eruption of the teeth? In the permanent class, I feel that there is no difference of opinion among orthodontists. Orthodontic therapy is indicated when malocclusion is noted. I must differ with Dr. Lewis regarding surgical treatment of the *fraenum labium.* When he first makes mention of the frenum, he states that many cases will correct themselves. Later, he says, "It seems wise to wait until the lateral incisors are in position before any surgical work is done." In my opinion, surgical interference is contraindicated in all conditions. By means of orthodontic appliances, an abnormal frenum can be slowly resorbed. This observation is based on an unfortunate experience in surgical treatment of a case.

A STUDY OF THE BEHAVIOR OF MUCIN SMEARS TREATED BY ACIDS, ALKALIS, SOAPS AND SUBSTANCES CONTAINING VITAMINE C*

By ANNA C. NICHOLS, B.S., M.S.; EDWARD H. HATTON, B.L., M.D., and J. A. DOHERTY, D.D.S., M.S.D., Chicago, Ill.

PICKERILL,[1] a number of years ago, argued that immunity to dental caries is based, in part, on the quantity and quality of the saliva, and that certain foods and substances are salivary depressants and others stimulants. Acid fruits and fruit juices are, he believes, powerful stimulants. Dentists who have observed carefully the effects of the wearing of full upper dentures on the salivary secretion and on the natural teeth in the lower jaw have noted in many instances a noteworthy change for the better with respect to both dental caries and pyorrhea. Monson,[2] of St. Paul, has frequently called attention to this phenomenon.

Gies,[3] some time later than Pickerill, suggested that the most important constituent to be considered in cleaning the teeth is the mucin in the saliva. Recently, one of his students, Inouye,[4] devised a method for preparing pure salivary mucin, but it is not easy to do and we have not been able to obtain a sufficient supply to experiment with it generously. On this account, it occurred

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-Fourth Annual Session of the American Dental Association, Buffalo, N. Y., Sept. 14, 1932.

1. Pickerill, H. P.: Prevention of Dental Caries and Oral Sepsis, Ed. 3, New York: Paul B. Hoeber, 1924.

2. Monson, G. W.: Personal communication to authors.

3. Gies, W. J.: Dentifrice Problem, J.A.D.A., 8:851 (Oct.) 1921.

4. Inouye, J. M.: Biochemical Studies of Salivary Mucin, J. D. Res., 10:7 (Feb.) 1930.

to one of us that gastric mucin might be used as a substitute for the former in studying the behavior of mucin films prepared on glass slides by treating them with a great variety of reagents. Because of the present interest in the treatment of gastric ulcer with mucin, it is possible to obtain generous amounts of gastric mucin for experimental work.

The method of preparing and treating such mucin smears given below was presented by one of us before the Chicago Branch of the International Society for Dental Research.

A 6.5 per cent preparation of gastric mucin in 0.25 per cent sodium carbonate solution was made, giving about the same p_H reaction as that of the saliva. These solutions are made up as follows:

Sodium carbonate, c. p. ..... 2.5 gm.
Distilled water ..... 1,000 c.c.

The carbonate is thoroughly dissolved in the distilled water. This solution must not be more than one week old.

Alcohol washed mucin ..... 1.0 gm.
Sodium carbonate solution prepared as above ..... 15.0 c.c.

The sodium carbonate solution is added to the mucin a little at a time and thoroughly mixed and stirred after each addition.

Thin films of this suspension of mucin are spread on glass slides (1 by 3 inches) and the slides allowed to rest in a horizontal position for from three to five minutes. New slides are used. They are first washed for some time in a standard acid bichromate bath, then removed and well washed in running tap water. The final rinse is in distilled water. Next, they are dipped in 95 per cent alcohol and wiped dry after removal from the alcohol bath.

Two methods were used to apply the reagents to the films, for the sake of comparison. Some of the films are flooded with the reagent to be tested and, at the end of twenty seconds, the slides are drained by gravity until no more liquid runs off. On other slides, the reagents are applied by dipping a small toothbrush into the fluid to be tested and stroking the brush wet with the reagent three or four times through the mucin film at right angles to the long axis of the film. The latter method has two advantages: part of the film on either side of the toothbrush path acts as a control, as it is not touched by the

Results Obtained in Tests

Reagent	p^H	Result
1. Castile soap solution	9.6	Film denser
2. Lime water	10.0+	Completely removed
3. Sodium hydroxide solution	10.0+	No effect
4. Milk of magnesia, 50%	8.6	Film denser
5. Citric acid, 0.1%	4.0	Slight decrease
6. Citric acid, 0.5%	3.6	Completely removed
7. Tartaric acid, 0.1%	4.2	Nearly removed
8. Tartaric acid, 0.5%	3.6	Completely removed
9. Acetic acid, 0.1%	4.0	Completely removed
0. Acetic acid, 0.5%	3.8	Completely removed
1. Lactic acid, 0.5%	3.8	Only slightly removed
12. "Galactonic lactone," 0.1%	6.8	Completely removed
13. "Galactonic lactone," 0.5%	6.6	Completely removed

chemical or the substance being tested; and, in the second place, some opportunity is given to compare the difference, if any, between the application of the tested substance with and without the mechanical assistance of brushing. These slides are then drained, in order to prevent the reagent from flowing onto the untreated mucin films.

All treated and control films are next fixed in a saturated solution of mercuric chloride for two minutes and finally stained for one minute in a 1 per cent solution of malachite green contained in a Coplin staining jar. After staining, the films are washed thoroughly with distilled water and dried. Distilled water is used in making up the fixative and the stain and the chemicals employed are pure. The stained films supply permanent records of the action of the chemicals and substances tested and may be photographed or used for demonstration purposes.

The accompanying table gives some of the results obtained by the use of this method of study.

A study of the films or of the photographs made from them supply more information than can be obtained from the table. This is especially true of the experiments made with soap solutions and milk of magnesia when the mixtures were applied with the toothbrush. It can be seen that the film is merely pushed from one place to another on the slide and that it seems to have been very sticky and quite dense.

A saturated solution of lime water, 0.5 per cent tartaric acid, 0.1 per cent acetic acid and 0.1 per cent "galactonic lactone" are very efficient in removing the mucin films. The use of soap solutions and milk of magnesia is without any positive effect, though it does seem to make the mucin much stickier. Film removal does not seem to be related definitely to either the degree of acidity or that of alkalinity. Lime water and sodium hydroxide of about the same degree of alkalinity do not act at all alike. The effect of the acid solutions cannot be predicted on the basis of their p_H reaction, as favorable reactions are found all the way from p_H 3.6 to 6.0. Lactic acid with a p_H of 3.8 is almost wholly without effect.

The sugar lactones of which a number are known have certain interesting properties. When they are dissolved in water, a portion of the lactone is converted into the corresponding acid, but there is a limit to this change, which is different for each one of the lactones. When this p_H limit is reached, no more lactone is converted into acid, but if the acid is used up or reduced in amount, more of the lactone is changed into acid. This process continues indefinitely until the supply of the lactone is exhausted. The p_H limit for the "galactonic lactone" is about 6.0, and the resulting acid is galactonic acid. All of the other substances listed in the table are well known.

The action of these reagents combined with other ingredients in the form of tooth pastes and dentifrices does not differ in any material respect from that of the pure substances; for example, tooth pastes containing soap, milk of magnesia and "galactonic lactone," when applied to the smears in the proportion of one part of paste to four parts water, produce exactly the same effect on the smears as do the pure substances. These results correspond in all essential details with the experimental data reported by Gies. They do serve to fortify the opinion expressed by him that substances which tend to increase the stickiness of

the salivary mucin are detrimental rather than useful and that those that make the mucin less adherent are valuable aids in cleaning teeth. It should be clearly understood that this discussion has nothing to do with the much discussed and little understood mucin plaque. It is also not concerned with the question as to whether the mucin film that presumably coats tooth surfaces is beneficial or harmful. No matter how thoroughly this mucin coating is removed in any artificial way, it is quite certain that a few minutes after such removal, it is entirely restored. On the other hand, fermentable food particles thoroughly mixed with salivary mucin and impacted between teeth or in pits and fissures against susceptible surfaces are, without doubt, held there in part by the adhesiveness of the mucin. It would seem more than probable that substances that increase this adhesiveness have no place in oral hygiene and that others which tend to loosen this attachment are the only ones that should have value in cleaning teeth. If this cleaning of teeth is a factor in preventive dentistry, and as long as the current theory of dental decay holds, these seem to be matters of material importance.

It must be remembered that the same substances that remove these mucin films are salivary simulants and, in Pickerill's language, both the quality and the quantity of the saliva is increased. It is quite possible that both characteristics of these substances are of material importance.

It should be said that the incorporation of acids in mouth washes, dentifrices and tooth pastes is associated with no little hazard and should be given critical consideration. There is a temptation on the one hand to introduce amounts of the acid nto the preparaton that cannot be tolerated in the mouth or be used continuously without damage to the teeth and gums. On the other hand, if the limit of toleration and harmlessness is maintained, the preparation is likely to be without effect, if we allow for the dilution and attenuation of the acid preparation by the fluids of the mouth. It is true that the sugar lactones, with their peculiar and unique property of limiting the liberation of acid to a known and harmless level and of maintaining this level up to the exhaustion of the supply of the lactone, seem to possess all of the qualifications needed for this purpose. They are nontoxic and may be introduced into preparations in large enough quantities to overcome all danger of dilution and attenuation when used with dentifrices in the mouth.

In this discussion, we have no purpose other than to present these facts and urge members of the profession to have a greater interest in the aids to mouth cleaning. It is our opinion that they should be familiar with this whole problem and that they should be in a position to either prescribe or advise the use of dentifrices that fit the requirements of their individual patients. When proprietary preparations are recommended, they should insist that the container supply no other information than the name, the formula and simple, concise directions for their use. The danger of the use of proprietary preparations lies in the well known facts that unscrupulous manufacturers may change or adulterate the article suddenly or without warning and that successive batches of the product may vary in essential details. Most manufacturers are very hesitant to reveal the exact composition of their products. The user is entirely dependent on the honesty and faithfulness of the producer. In this

connection, we urge that members of this Association both serve and be served by the Council on Dental Therapeutics in these and other matters that have to do with the use of drugs and therapeutic agents. In controversial matters, it may be critical; but, in all cases, it is eminently fair. Members may be of assistance to the Council in collecting facts (not opinions) that may be brought to bear on such questionable subjects.

One phase of these experiments remains to be discussed. It was quite natural that this study of the behavior of mucin films should be extended to include experiments with fruits and fruit juices whose reactions are acid. The first results were so suggestive that we have included most of those that are particularly high in vitamine C content. Tomato juice, orange juice, lemon juice, pineapple juice, grapefruit juice and apple juice are surprisingly effective. There is some variation. For example, orange juice is more efficient than lemon juice.

This coincidence of high vitamine C content and the ability of these fluids to remove mucin films seems to be a matter of considerable importance, because of the belief in certain quarters that dental decay is due to a deficiency of vitamine C.

Because of the definiteness with which dental decay is confined to specific areas on tooth surfaces, often involving only a single tooth or, as a rule, relatively few teeth, it is hard to conceive that the primary cause is to be found in the lack of an agent whose action is diffuse and not sharply focused on these susceptible areas. This belief has a substantial foundation of uncontradicted opinion and repeated clinical observation over a great many years, and deserves more attention at the hands of the vitamine C proponents than it has apparently received.

On the other hand, agents whose action is wholly local and brought to bear on the external surfaces of both the teeth and the gums may affect the incidence of dental caries and even of gingivitis or pyorrhea. One may, therefore, suspect that the favorable effect, if any, of orange juice, etc., especially when used in very liberal amounts, is due wholly to the local action, especially since it can be shown that they are all very effective in loosening mucin smears. They are merely aids in removing such débris mixed with mucin as has become impacted in susceptible areas.

It should be remembered that lactic acid is one of the least effective of the organic acids in loosening these mucin smears. One of us has been able to demonstrate that it requires not less than a 6.0 per cent solution to effect complete removal. This is probably a matter of major importance and not merely a curious contradiction, since it is lactic acid produced by the fermentation of food particles that brings about the decalcification of the enamel, according to the current theory of dental decay.

It is our impression that the action of the saliva and other fluids and substances that are brought in contact with the teeth from the outside is not all that is concerned in the causation of dental decay. There is also the external surface of the tooth. In our opinion, it is not the hardness of this external surface nor its organic covering in which this secret is locked, but the character or the arrangement of the mineral crystals in that outer surface.

We have been able to confirm by a new method the experimental data reported by Gies. This method, we be-

lieve, may be of some value not only for experimental purposes and for testing the properties of dentifrices, but also for visualizing and demonstrating the behavior of mucin under various conditions. A few comparative tests made on salivary and gastric mucin agree in all essential respects.

(It should be noted that the films prepared in the method described are not washed until after fixing and staining. The films are all removed by running water before fixation. Treatment of the film before fixation does something to it that changes its degree of adhesiveness to the slide after fixation so that there is a very clean cut difference between slides treated by the various reagents used. It is on this difference in behavior that this discussion is based. This does not at all duplicate conditions as found in the mouth.)

UNUSUAL FOREIGN BODY IN THE CHEEK

The shell of a .22 cartridge in a masseter muscle is, I think, a really unique condition. An eleven-year-old boy was brought to the hospital with a story that three weeks previous in a small town one hundred miles away he had been playing with an old type of single shot breech loading .22 rifle which "broke" in the middle. This was designed for a .22 short cartridge. The boy got hold of some .22 long ammunition and when the cartridge failed to go in completely he held up the open barrel and tried to push it in with a pocket knife. It went off and the bullet lodged in the gun barrel. The shell was thrown back and entered the left cheek a half inch behind the angle of the mouth. Nothing was done for three weeks and most of the swelling had subsided when he was taken to a hospital and an incision was made inside the mouth in an attempt to locate and extract the foreign body. This failed and I first saw him two days later with a very extensive cellulitis of his left face and some trismus. He was sent home. Mouth irrigations and cold applications were ordered and an analgesic given. He got worse and two days later was admitted to the hospital where the same régime was continued. The second night after admission an abscess burst inside his mouth and the edema and temperature rapidly subsided. An x-ray now showed the shell of a .22 long cartridge slightly behind and above the left lower unerupted last molar. Under general anesthesia an external incision was made in the direction of the facial nerve fibers and the parotid duct. The foreign body could not be felt. Confident that it must be near, an incision was made in the masseter muscle and a large cystic space filled with sanguinopurulent material was opened. The shell lay in this. It was extracted and the cavity packed to control hemorrhage. The wound was closed with a gauze wick emerging through the skin. At first there was a noticeable muscle weakness about the angle of the mouth, but this has practically disappeared.—Richard Joseph White, in *American Journal of Surgery*.

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Editorials

THE QUESTION OF PYORRHEA

Never in the history of dental disease has there seemed such confusion as has been manifest in connection with the question of pyorrhea. Even its name has been bandied about by the profession till it seems that every group has a different term to suggest. A writer, years ago, listed the various names that were given this disease, and while we have forgotten the exact number, they were sufficiently numerous to bewilder the reader.

But with all of this, the name seems settled rather definitely. Custom has attended to that, as has been the case with many of our terms even when there was little logic in the choice. All the logic in the world will not make the rank and file of our profession or the rank and file of the public use the term periodontoclasia instead of pyorrhea. The former term may express more definitely

the character of the disease, but the latter has been woven into the fabric of the literature so long that it has become part and parcel of our tradition, and even if the profession tried to eschew it, the people would still adhere to it. The making of a language is not altogether controlled by a Noah Webster; the gamin on the street introduces a pat phrase, and it eventually becomes akin to a classic.

Yet there is a very patent reason that the nomenclature of this entity has been so confused. Mostly, it is due to the fact that there have been so many manifestations of the disease apparent in the mouth, each of which has appealed to the individual observer, or to groups of individuals, as demanding description and calling for a certain term to designate it. Thus, there has seemed some logic in almost every name that has been suggested for the disease, because of the varying manifestations that from time to time have been presented, and we can surely afford to be somewhat charitable in the face of so many apparently confusing terms.

But what shall we say of the affection itself? The statement has frequently been made that more teeth have been lost from failure of the supporting structures of the teeth than from dental caries, even with the accepted fact that tooth decay is more prevalent than any other human ailment.

It might have been well if long ago the members of the profession had more generally recognized the patent fact that there are varying manifestations of this affection, or even that there are actually different pathologic conditions grouped under the general head of pyorrhea, which accounts for the difference in behavior of the affection after treatment.

There has been a sad discrepancy in the diagnosis and management of this disease, and, if possible, a greater discrepancy in its prognosis. There has frequently gone out from the offices of various men the statement that there is no cure for pyorrhea, and this is fallacious. No one with judgment will assert that pyorrhea can always be cured—it cannot. But to make the off-hand statement to patients that pyorrhea cannot be cured and to let the matter go at that without further ado is to promulgate an erroneous doctrine that has caused the loss of many valuable teeth. If there is one

thing that is capable of definite demonstration it is the fact that very many of these teeth, even so far involved as to show the evidence of pus and a slight loosening of the teeth, may be so perfectly cured that the pus stops entirely, the teeth become firm and the gums are again pink and healthy. And, with proper care, this fortunate condition can be maintained for many years, to the great comfort and the health of the patient, and, in some instances without question, to the added longevity of the individual.

The attitude of *laissez-faire* in connection with the question of pyorrhea on the part of too many dentists is alike discreditable to the profession and disastrous to the patient, and mayhap it might not be illogical to assume that, in other relations of our professional experience, the sin of indifference is accountable for certain of the discrepancies that occur in the confidence that should invariably obtain between patient and practitioner. To go a step farther: May not even some of our present economic stress have a basis in this same tendency to drift along the lines of least resistance and sidestep a responsibility, whether it be in connection with the treatment of a disease or with the solution of a knotty problem in economics?

If dentists are to succeed, either in the treatment of disease or in the management of their material affairs, they must key themselves up to a most intense and serious application to their various problems, and they must no longer throw up their hands over this question of pyorrhea and permit the doctrine to be promulgated generally among their patients that this disease cannot be cured. And each practitioner, assuming like a man the responsibility that actually belongs to him, should early make himself sufficiently familiar with the disease to be able to say in any given case whether the trouble can be cured, and in case it cannot, the patient should be frankly informed. When there is doubt, if the general practitioner feels his inadequacy, he should refer the case to a specialist in this work and give the patient the benefit of all the latest information on the subject. To do less than this is to shirk a duty and to condemn many patients to the loss of their teeth, which, with proper care, might have been saved.

A FACT-FINDING COMMITTEE OF THE AMERICAN DENTAL ASSOCIATION AND THE U. S. PUBLIC HEALTH SERVICE

At the Buffalo meeting the Reference Committee reported as follows:

Your Legislative Reference Committee has had referred to it by the House of Delegates a suggested program for more efficiently promoting the activities of organized dentistry, submitted by the Chairman of the Standing Committee on Legislation. Your Committee feels that this suggested program is vital to the best interests of organized dentistry and broad in its scope, in that it deals with the necessity for creating an effective plan of outlining a program for the future check-mating or offsetting of potential menacing threats which confront the profession of dentistry. It is also the opinion of your Reference Committee that a special committee should be appointed by the American Dental Association to create or develop a constructive program to combat the tendency of so-called state or panel dentistry and to make a thorough survey of all dental activities in state, county and municipal health organizations; and to recommend a policy which would be applicable to state, municipal and county health organizations in order that organized dentistry may be prepared, if and when the time ever comes that we are confronted with state, panel or insurance dentistry, as are other countries in the civilized world; and in order that these completed plans can be brought before backward states so that dentistry may be efficiently represented in state, municipal and county health organizations.

In a statement made to the Board of Trustees in February, 1933, by Dr. C. T. Messner of the U. S. Public Health Service, we find the following:

Soon after taking office the President of the American Dental Association, Dr. G. Walter Dittmar, realizing that the American Dental Association had no funds to carry on this extensive program and believing that the work of this committee, if properly developed, would promote the health of the public at large, took up the matter with officials of the U. S. Public Health Service to determine whether or not such a survey could properly be undertaken by that Service in the interests of the public health. After considerable correspondence the President of the American Dental Association, the President of the Association of Dental Examiners, the Secretary of the American College of Dentists and the Chairman of the Legislative Committee of the American Dental Association met with the Surgeon General of the U. S. Public Health Service, Dr. Hugh S. Cumming, on December 7, 1932, and discussed with him this proposed activity.

Realizing that the results of such a survey would more firmly establish dentistry in public health activities throughout the nation, the Surgeon General gave his approval and agreed to authorize experienced dental officers of the U. S. Public Health Service to make the survey, working in cooperation with a committee of

the American Dental Association, of which C. T. Messner, D.D.S., Washington, D. C., has been appointed chairman.

The Committee for Dental Health Survey will be composed of twenty-nine members representing the professional, educational and civic phases of dentistry. Ten members have been selected from this committee to serve on the Executive Council.

As the survey progresses, periodical reports of conditions found will be submitted to each member of the committee in order that he may familiarize himself with the progress of the investigation and fully understand the subject when the committee as a whole meets to formulate their recommendations.

The survey to be made covers a wide range of subjects, all of which cannot be enumerated here. It will embrace the major questions concerned with the dental activities of state, municipal and county organizations. In all, there are twenty-four topics outlined for consideration, each having a bearing on the problem. Till this committee functions, we shall not know all there is to know of the social, the professional and the economic status of dentistry and its relationship with the medical profession and with the various welfare groups and society at large. In particular, we should care to know every aspect of the activities embraced in the work of our own Association as represented in the Bureau of Public Relations.

This is the most concrete effort yet made to learn the facts concerning some of the most intimate and intricate problems confronting the profession today, and the committee is hereby urged to devote its best energies toward the consummation of a piece of work that promises much for the advancement of dentistry.

It will become apparent at once that dentistry is placed under the deepest obligation to Surgeon-General Cumming for his spontaneous and whole-hearted offer to cooperate with our Association in this important and praiseworthy activity. It is a gesture that will not only redound to the benefit of our citizens, but will also call forth the universal gratitude of the members of our profession.

THE MEETING OF THE BOARD OF TRUSTEES, FEBRUARY 5-6, 1933

It may be desirable to refer to a few of the high lights of the February meeting of the Board of Trustees in addition to some of the actions already reported in *The Journal.* In the March number, attention was directed to the tie-up with the U. S. Public Health Service in the matter of educational publicity; and, in this issue, reference is made to a movement sponsored by the President, Dr. G. Walter Dittmar, and the Surgeon-General of the U. S. Public Health Service, Dr. Hugh S. Cumming, whereby a survey is to be made, a fact-finding committee of about thirty prominent members of our Association cooperating with the U. S. Public Health Service in a study of economic and other problems of the day.

In the April issue of the *Journal of the Indiana State Dental Society,* the editor, Dr. R. N. Douglas, outlines many of the outstanding actions taken at the recent meeting. Among other things, he says:

> When the Board of Trustees of the American Dental Association held its annual mid-winter meeting in Chicago, February 5-6, several important items of business were transacted which revealed that the present administration is going ahead with a progressive program in spite of the fact that, as a profession, we are in the midst of and a part of one of the worst economic disturbances that this country has ever known. This is a good omen. Instead of marking time or giving up in discouragement, our administration chooses to advance and keep up the unusual progress which has marked the growth of our profession in the past twenty-five years.

The Trustees also voted to supply THE JOURNAL to senior dental students as an incentive to membership in the Association on graduation. This is an excellent move, as also is the action of the Board to grade life insurance premiums of the A.D.A. members, to go into effect July 1, 1933, as follows: $6.00 per thousand for members in the twenties; $8.00 in the thirties; $10.50 in the forties, and $16.30 after the age of 50.

Incidentally, in the issue of October, 1932, Millard D. Gibbs of Arkansas published an article, "Life Insurance and the Medical Examination," that has something of interest for every one of our

members who plan to take advantage of the group insurance privilege offered.

To quote again from the article by Dr. Douglas:

> In addition to these special considerations a great deal of routine business was transacted by the Board. One little realizes the immense amount of work which is accomplished in these two-day sessions of the Board. Every hour is filled to the limit. If an outsider could be privileged to "listen in" on the entire proceedings of such a session, he could undoubtedly satisfy himself as to "what makes the wheels go 'round" in this huge organization of ours, committed to the best interests of its membership.

A BASELESS RUMOR

Word is being passed along, at whose instigation we do not know, that the hotels and restaurants of Chicago are to make excessive charges during the Century of Progress Exposition. This is unworthy propaganda pure and simple.

We are authorized to state that during the meeting of the American Dental Association and the Chicago Centennial Dental Congress, August 7-12, 1933, the Stevens Hotel, which has been designated headquarters, is under contract to supply rooms and meals at a greatly reduced rate over those in force five years ago and this holds good with all Chicago hotels. The reduction in rates obtains not only in regular hotel accommodations, but in the case of banquets and other public functions, the price per plate being much lower than in previous years. The very first function of the officers of the August meeting was to arrange with the hotel people for moderate rates and unsurpassed accommodations. Excessive rates were tabooed from the beginning, and the comfort and welfare of the visitors were guaranteed by agreement.

Chicago is prepared not only to put on one of the greatest dental meetings in history, but also to make the rates to the visitors so very attractive that the restriction in purses so prevalent in these days will be more than compensated for. Plan to come to Chicago with the assurance that the event will be really outstanding in a scientific sense, and filled with entertainment in connection not

only with the Diamond Jubilee and the Chicago Centennial Dental Congress but also with the Exposition itself.

This great enterprise is now rapidly nearing completion, and we are assured that for once a world's fair will be ready on time, and that visitors will be able to enjoy themselves without expenditure of any great sum and without the handicap of inadequate preparation.

Obituary

FORREST HOY ORTON, D.D.S.

(1867-1933)

Forrest Hoy Orton, student of dentistry and professor of crown and bridge prosthesis in the University of California College of Dentistry, died March 1, 1933. Born in Shelby, Ohio, Sept. 15, 1867, he moved to Duluth, Minn., with his parents in 1873. He began the study of dentistry in the office of Dr. Hillyer, of Duluth, in 1886. In 1887, he continued his studies with Dr. Lyons, of St. Paul, and also attended the St. Paul Medical College. In 1889, he entered the Dental School of the University of Minnesota, remaining for two years. In 1891, he came to the University of California wth Dr. W. Xavier Sudduth, of Philadelphia, whom he assisted in the teaching of embryology and histology, while continuing his dental studies. He graduated with the degree of Doctor of Dental Surgery, in December, 1891.

After his graduation, Dr. Orton returned to St. Paul to enter practice. His rise in the profession was rapid and, in 1893, he was elected president of the Minnesota State Dental Association. From 1895 to 1898, he served as a member of the Minnesota State Board of Dental Examiners.

The University of Minnesota called him to fill the newly created chair of professor of crown and bridge work in 1899. This marked the first division in the field of prosthetic dentistry. He held this position until his removal to California in 1923. During these busy years, he studied psychology, esthetics, logic, philosophy and other subjects in the college of liberal arts. On his arrival in San Francisco, he became professor of crown and bridge prosthesis in the College of Dentistry, University of California. He filled this position until his death.

Very early in his career as a practitioner, Dr. Orton recognized the possibilities of his chosen specialty, and he ever after gave to it all of his ability, strength and enthusiasm. His fame as a skilful and brilliant operator soon brought him world-wide demands for lectures and demonstrations. In 1912, he was invited to Norway, where he received an honorary scientific degree from Norske Tandlagforening. While on this trip he gave instruction at the universities of Copenhagen and Stockholm. In

FORREST HOY ORTON, D.D.S.
(1867-1933)

1921, he was again called to Norway and Sweden, this time to be honored with a degree from the Swedish Tandlagforening.

Dr. Orton was widely honored by the profession in the United States and was made an honorary member of the National Society of Denture Prosthetists, the National Society of Reconstruction Prosthetists and the state dental associations of North Dakota and California. He was a life member of the Minnesota State Dental Association and the American Dental Association, and was a Fellow of the American College of Dentists. He delivered many lectures throughout the United States and contributed numerous articles to dental periodical literature. Some of these have been translated into five languages.

During his residence in St. Paul, Dr. Orton was impressed by a suggestion of the late Edward H. Angle that the profession should adopt a more scientific method for diagnosing dental anomalies and mutilations. He instantly accepted Dr. Angle's belief that plaster denture reproductions enabled one to judge deviations objectively, and he followed this method ever after in his practice and teaching. He frequently stated that far too many operative procedures were based on mere subjective opinions and far too few on adequate objective data.

Dr. Orton married Adah L. Hawkins, who survives him with two sons, Mark de Forrest and Frederick T. Orton, a daughter, Mrs. James Towle, and a sister, Nellie Orton.

Forrest Hoy Orton lived a life that was vast in experience and rich in knowledge and he possessed the rare power of applying them practically and critically. He was a devoted husband and father, an able and skilful practitioner and teacher, an indefatigable student of literature, science and the arts, and a noble, kindly and generous friend. Although his death has left a void which can never be filled, his life and accomplishments will shed an ever-widening influence for good.

BENNO E. LISCHER,
J. RAYMOND GILL.

COUNCIL ON DENTAL THERAPEUTICS

ACCEPTED DENTAL REMEDIES

The following articles have been accepted as conforming to the rules of the Council on Dental Therapeutics of the American Dental Association for inclusion in the list of Accepted Dental Remedies. The Council desires dentists to understand that the admission of an article does not imply a recommendation. A copy of the rules which govern the Council in the consideration of articles will be sent on request.

SAMUEL M. GORDON, *Secretary*

HALIVER OIL WITH VIOSTEROL 250 D-Abbott.—Halibut Liver Oil with Viosterol 250 D-Abbott.—Halibut liver oil adjusted by the addition of maize oil to have a vitamine A potency of not less than 30,000 pharmacopeial units (U.S.P.X) per gram and by addition of a sufficient amount of viosterol in oil 250 D to assure a vitamine D potency of not less than 250 D (250 times that of the standard cod liver oil defined by the Wisconsin Alumni Research Foundation [or 3,333 units (Steenbock) per gram.])

Actions and Uses: The same as those of cod liver oil. (See general article, Cod Liver Oil and Cod Liver Oil Preparations, J.A.D.A. 17:1941 [Oct.] 1930.)

Dosage: At the present time, there is no basis for dosage of vitamine A and D products where caries and tooth health are concerned. There also are no accurate data available concerning the *direct* effect of vitamines A and D on the prevention of caries. Animal experiments indicate that vitamines A and D may be factors in the proper calcification of the teeth. Until more definite data are available, the dosage which follows, based on prophylaxis against rickets, is given:

For infants, 8 to 10 drops (3 to 3.5 minims) daily; for premature and rapidly growing infants, 15 drops (5.25 to 7 minims) daily; for adults, especially nursing and expectant mothers, 20 drops (7 minims) or more daily. The marketed preparation is accompanied by a special dropper designed to deliver approximately 3 drops to the minim.

Manufactured by the Abbott Laboratories, North Chicago, Ill. U. S. patent applied for. Trademark No. 294,692. The viosterol in oil 250 D used is manufactured under U. S. patent 1,680,818 (Aug. 14, 1928; expires 1945) and 1,871,136 (Aug. 9, 1932; expires 1949) by license of the Wisconsin Alumni Research Foundation.

Soluble Gelatin Capsules Haliver Oil with Viosterol 250 D-Abbott, 3 minims: Each capsul contains 3 minims of haliver oil with viosterol 250 D diluted with 3 minims of vegetable oil.

Haliver Oil with Viosterol 250 D-Abbott is prepared by combining halibut liver oil and viosterol in oil 250 D in such proportions that the finished product will have a vitamine A potency of not less than 30,000 pharmacopeial units (U.S.P.X) per gram, and a vitamine D potency of not less than 3,333 units

(Steenbock) per gram. The halibut liver oil is assayed for vitamine A by the method described in the *Journal of the American Pharmaceutical Association* (19:616, 1930), and for vitamine D by the method of the Wisconsin Alumni Research Foundation (Viosterol, J.A.D.A., 18:1785 [Sept.] 1931.) The potency of the finished product is arrived at by a calculated dilution of the previously assayed oil, though some batches are biologically assayed.

WARD'S TOOTH PASTE. Composition: Each 100 grams is stated to contain, approximately: glycerine, 25.5 gm.; calcium carbonate, 30.1 gm.; powdered neutral soap, 1.2 gm.; magnesia hydroxide, 4.9 gm. (equivalent to approximately 75 per cent milk of magnesia, U.S.P.); powdered gum tragacanth, 0.9 gm.; saccharine, essential oils for flavoring, color and water to make 100 gm.

Claims: No claims, except that it is an agent to be used for cleaning the teeth when used with a toothbrush, are made.

Manufacturer and distributor: Montgomery Ward & Company, Chicago, Ill. No U. S. patents or trademarks.

LACTONA DENTIFRICE. Composition: Each 100 grams contains glycerine, 24.5 gm.; dicalcium phosphate, Victor (less than 400 mesh) 54.0 gm.; galactonic acid lactone, 3.0 gm.; water, 10.0 gm.; ethyl alcohol, 4.0 gm.; petrolatum 1.0 gm.; gum tragacanth, gum Karaya, each 0.75 gm.; malic acid, 0.25 gm.; sodium chloride, 0.6 gm.; saccharine, 0.07 gm.; menthol, oil of peppermint, etc. (flavoring) 0.8 gm.

Claims: The manufacturers agree to limit the claims for the product as an aid in cleaning the teeth.

Preliminary evidence submitted by the firm indicates that galactonic acid lactone in solution or in a tooth paste aids in removal of a smear of gastric mucin from a glass slide. This property is shared by lime water, sodium chloride solution, citrus fruit juices, tartaric and citric acids. (Hatton, E. H.; Nichols, Anna C., and Doherty, J. A.: Study of the Behavior of Mucin Smears, Treated by Acids, Alkalis, Soaps and Substances Containing Vitamine C; J.A.D.A., to be published.)

As far as an analogy between the gastric mucin smears and the covering of mucin on the teeth holds, the removal of salivary mucin from the teeth can be considered only temporary. In all probability, the teeth from which salivary mucin is removed would again become coated with mucin in a very short time.

The U. S. Patent Office has issued the following patents for a tooth-cleaning preparation containing galactonic acid lactone and other sugar acid lactones: 1,445,352, Feb. 13, 1923; 1,516,206, Nov. 18, 1924; Re. 15,691, Sept. 25, 1923; original 1,445,351, Feb. 13, 1923.

A member of the Council has studied the foregoing patents. In his opinion, the Council could not acquiesce in the validity of the claims allowed in those patents, as they pertain to the product described above as Lactona Dentifrice, because of the inclusiveness of the claims in the patents to cover other lactone and galactonic acid lactone products; because no evidence is available to support the tartar removing claims made in the patents, and because the composition of Lactona Dentifrice as given above, made acceptable to the Council, was not included in any of the patents submitted and, further, because acquiescence

in the patent claims on the part of the Council, acting for the American Dental Association, might act to inhibit the prescribing of acid lactones of this type by the individual dentist when, in his judgment, such products might be useful for conditions under his care, as such a patent grants a virtual and unfair monopoly for the use of a substance which is amply described in the chemical literature.

It is pertinent to point out in this connection that the issuance of patents for dentifrices by the Patent Office needs more serious consideration than has been apparent from a study of many patents issued for dentifrice mixtures in the past. An investigation of a number of patents issued by the Patent Office for dentifrices indicates that they have been granted without complete and thorough investigation of the claims advanced therein. Such a state of affairs is not in the public interest. The Council urges, as a means of improving conditions, that the U. S. Public Health Service, the Food and Drug Administration of the Department of Agriculture and other scientific departments of the U. S. Government conversant with medicine and related subjects, be consulted before the issuance of patents for therapeutic or oral hygiene preparations relating to dentistry.

Manufacturer: Pfanstiehl Chemical Company, Waukegan, Ill. Distributors, Lactona, Incorporated, St. Paul, Minn. Trademark No. 248,109.

BUREAU OF PUBLIC RELATIONS

MAY DAY—NATIONAL CHILD HEALTH DAY—1933

By GEORGE H. WANDEL,* D.D.S., Chicago, Ill.

ONCE more the opportunity is at hand for the members of the dental profession to lend their aid to a very worthy cause. May Day—National Child Health Day will soon be here. It has become a recognized national institution in the interests of child and maternal health. The first day of May is designated each year as the day on which the nation takes special note of the well-being of its children and mothers. The keynote for this year's May Day is "Mothers and Babies First."

The major aims in this great work are in every state as follows:

To inform the general public of the program and need for maternal and child health work in the state.

To organize permanent children's councils.

To urge unity of effort in each community toward the accomplishment of one or two child health objectives for the year-round program and for May Day.

To stimulate the holding of child health conferences.

To arouse public interest in and support for appropriations for the health and welfare of mothers and children.

It has been with great pleasure that we have observed the increasing interest and cooperation in this activity on the part of the dental profession in many communities. And that is as it should be. Dentistry is recognized as a definite part of health service. There is no place in the field of public health where dentistry is so important as it is in the care of the child and the mother.

Dentistry has forged ahead in many localities in the care of children. But there are still thousands of communities in which little or nothing is being done to safeguard child health against dental disease. Who is at fault in these instances? In most cases, the blame must be placed largely upon the shoulders of the dental profession in those areas. It cannot be otherwise, since, in those sections where something is being done, accomplishment has been the result of the aggressive and persistent action of progressive and public-spirited members of the profession. Dentistry has never had anything handed to her on a silver platter. Whatever progress has been made has resulted from the hard work of individuals and the coordinated efforts of the profession itself.

These are trying times. Practices have dwindled. Community health activities, especially those dealing with children, have received serious set-backs and, in many cases, are threatened with abandonment. Any further backward movement must be met with determined opposition. The continued education of the public

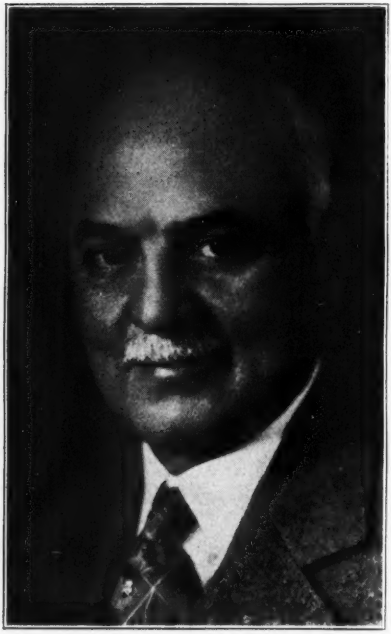
*Supervisor, Bureau of Public Relations, American Dental Association.

in matters pertaining to child health and maternal care and the maintenance of financial support for such programs, as well as increased effort toward the organization of programs in backward communities, are as much the responsibility of the dental profession as of any other existing group. This period of depression and uncertainty is not going to last forever. There is bound to be a change for the better. Forward looking persons are now laying plans for that better time. Is there any one thing that offers greater promise for the future of dentistry than an active encouragement of and participation in health activities for the mother and child? Has not the care of the mother and child become dentistry's focusing point for effective preventive and reparative treatment? Then why should not every member of our profession who is desirous of seeing his profession advance, who has at heart the welfare of his fellow-men, not rouse himself to an interest in things beyond the confines of his office and take an active part in May Day and the things for which it stands?

The state May Day chairman in practically every state is the director of the division of child hygiene in the state department of health. It is suggested that the mouth hygiene or public relations committees of local and state dental societies get into immediate touch with their local or state May Day chairman and seek an opportunity to assist in the May Day activities.

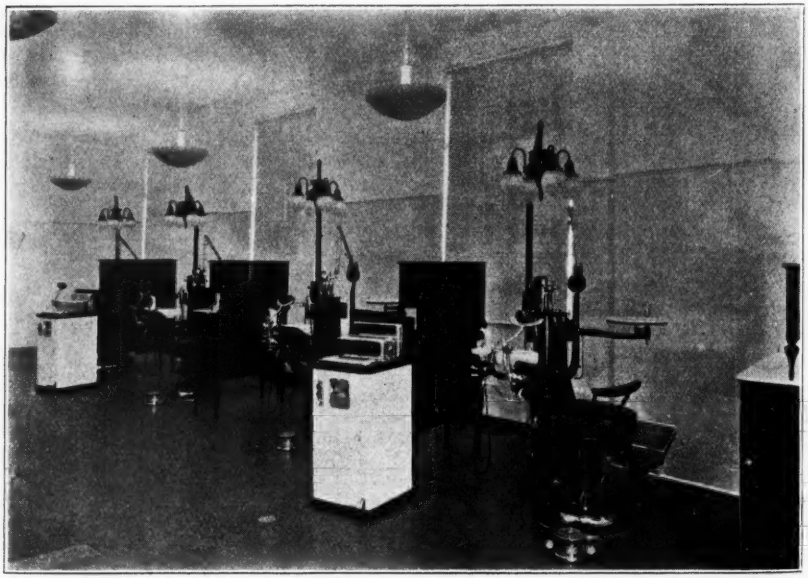
Don't take "no" for an answer. Make it clearly understood that the request is a sincere one and that dentistry is positively in earnest in its desire to take part in this important work. In communities where nothing has been done in the past, it is entirely within the rights of the dental profession to urge influential citizens to interest themselves in the adoption of a program for May Day. Assistance with and information concerning the organization and development of such a program can always be obtained from the above mentioned state May Day chairman.

There is no greater asset to the community or the nation than healthy mothers and children. There is nothing that is more important in the foundation of a successful dental practice than the proper care of the mother and child. That "the child patient of today is the adult patient of tomorrow" is no idle statement. Then, giving cognizance to that fact, let us bend every effort toward making a success of the 1933 May Day—National Child Health Day.



Right: Angelo J. Rossi, mayor of San Francisco. Economy in local government and the exigencies of a new charter recently adopted by San Francisco almost cost the loss of the city's dental clinic for children. That it was saved was due to the steadfastness of Mayor Angelo J. Rossi in his high regard for dentistry.

Below: San Francisco's newest dental clinic for indigent children of the public and parochial schools, in the new Health Center Building. The clinic is equipped with four chairs and dental units and provision is made for twelve. There are also five one-chair school clinics and two social center dental clinics of one chair each.



THE ALABAMA MOUTH HYGIENE PROGRAM

By CHALMERS B. WEBSTER,* D.D.S., Montgomery, Ala.

THE Division of Oral Hygiene of the Alabama State Department of Public Health, established in 1928, is a part of the Bureau of Preventable Disease Control. Its purpose is the prevention and correction of dental disease through promotion and education.

General plans include:

1. Organization of local county dentists to assist county health departments in giving free dental examinations to preschool and school children.
2. Promotion of dental corrections and oral hygiene through the family dentists, with the cooperation of teachers and health forces, instead of the establishment of free dental clinics.
3. Dental health education at the teacher training colleges and at other institutions of higher learning.
4. Distribution of educational and instructional material.
5. Dental health education to the general public by radio and news articles.
6. Emphasis on the necessity of mouth, health reaching civic clubs, parent-teacher associations, mothers' clubs and the public schools through lectures and the use of moving pictures and lantern slides.

ACTIVITIES OF ORGANIZED DENTISTRY

At the outset of the program, it was realized that the interest of the private dentist must be aroused in public health and preventive dentistry. Until within the past few years, dental colleges offered practically no training in children's dentistry. Therefore, a large number of the profession had little knowledge of this work and naturally had not disseminated this information to their clientele. The state board of dental examiners, the officers of the Alabama Dental Association and the more progressive dental leaders of the state for years attempted to secure the establishment of a dental hygiene program as a regular part of the state's public health program. When this was accomplished, they immediately lent the organized forces of the Alabama Dental Association to build up the interest and activity of the private practioner in preventive dentistry and public health work.

For the past five years, the state association has consistently imported and presented an array of talent to its members on these subjects. These clinicians and lecturers represent the nation's most able dentists and public health workers. As a result of these efforts on the part of the state association, many who formerly refused to serve children or at best did so half heartedly have changed their point of view and may now be depended on to render a far superior type of service to children. The bulletin of the association has given publicity to the activities of the state work, and every encouragement to our endeavors. The effort of the state association, coupled with that of the health forces, has developed a strong sentiment for public health in dental circles.

*Director of the Division of Oral Hygiene, State Department of Public Health.

DENTAL HEALTH WORK AT TEACHER TRAINING INSTITUTIONS

Realizing that prevention begins in early life, we spend our efforts principally in school work. Knowing full well the tremendous influence the teacher has on the child, we included in our activities from the beginning a definite plan to enlist the aid and support of this group. To accomplish this, a dental health clinic has been conducted each summer at the University of Alabama, Alabama College for Women, and the four teacher training institutions. These clinics have been invaluable in stimulating teacher interest in dental health. During this period, the mouths of 10,606 teachers and prospective teachers have been examined and charted, and more than 700 lectures have been given. The extension of this feature is based on the assumption that (1) the teacher must have a basic understanding of the essential importance of oral health; (2) the actual demonstration through thorough prophylaxis is a most convincing argument, and (3) if the teacher can be converted to the necessity of keeping her own mouth clean, she can in turn be interested in obtaining the cleanliness and health of the mouths of the children that she teaches.

The work during the past two years has been supplemented by an educational prophylaxis clinic. In this clinic, a select group is given a thorough prophylactic treatment, which includes scaling and cleaning the teeth, the use of floss without injury, gum massage, and an efficient common sense toothbrush technic (simple enough that the teacher can apply it in teaching her grade pupils). During the prophylactic treatment, the hygienist gives the patient a talk on mouth health. Prophylaxis is offered first to those who are in a more or less administrative position, such as county and city superintendents of education, county and city elementary supervisors, physical and health education teachers, principals of elementary schools and experienced teachers, and then to the senior students. Although the service is confined to a select group of teachers who are to teach the children of this state, the demand is far beyond our ability to supply it.

Students are assigned to the examination and lecture in groups of twelve to fifteen each hour. Displays of posters, health projects and educational materials which have been used in the promotion of oral hygiene to the public schools are on exhibit in the lecture hall. It is gratifying to note the interest the teachers take in the display. Many of them ask permission to utilize the projects in their own schools. In this connection, it may be stated that before the students are allowed to view the exhibit, the college supervisor of elementary education and, in some instances, the art teacher, is requested to review the material in order that nothing may be presented which is not pedagogically sound.

A thorough discussion of all details and data pertaining to the prevalence of dental disease among this group would be quite lengthy. It appears that as they represent perhaps the highest degree of intelligence of all units in the state, they would have fewer dental defects than any other group. Yet the examination, in 1928, of 3,149 with a median age of 23 years, showed an average of five defects per student. Forty-five per cent of the males and thirty-five per cent of the females had some form of gum trouble. The examination of 1931 (statistics for 1932 not compiled) revealed a decrease of 40 per cent in the average defect per student, and a decline of 26 per cent in gingival disease. The group examined in 1931 was composed of only a small per-

centage of those individuals examined in 1928. This fact indicates that the students attending teacher training institutions in 1931 had healthier mouths than those attending four years previously. There has been no change as to the character of the source of supply from which these students are drawn. Therefore, we can infer that the mouths of the general population of that age group throughout the state would show a like improvement. These results are evidence to us that this decrease has been effected through the efforts made by the division of oral hygiene in the higher institutions and in the public schools; furthermore, that these have led (1) parents to be more conscious of the importance of dental health; (2) older students to become likewise dentally conscious; (3) the dental profession itself to awaken to the importance and value of preventive dentistry. In addition, information obtained through the clinics has been disseminated widely over the state.

PUBLIC SCHOOL PROGRAM

Being dependent on the availability of the dentists, the extensiveness of the program varies. Sporadic attempts had been made before the state inaugurated its program. Since then, the work has assumed a more balanced aspect and has grown to include almost every county. In some counties, it has been possible to extend the work beyond the urban centers to cover considerable portions of the rural sections. Nearly always, in every county, some of the larger consolidated schools are included. Fifty-seven of the sixty-seven counties have carried on this work. Fifty-two of them have full time health units.

In the public schools, efforts are directed at correlating the interest of the teachers, dentists and parents with that of the health department in securing (1) health protection, (2) health promotion and (3) correction of defects.

Accordingly, a conference is had with all concerned and details are explained as to what is expected of each. The date for the beginning of the program is set and necessary forms and materials are sent to the local health department. All activities are centered in the county health department if there is one; otherwise, in the school system or parent-teacher organization.

The dentists give enough of their time to examine the mouth of each child. An individual certificate is awarded to those children having no dental defects when examined. To all children whose defects have been corrected, the family dentist gives a dental health certificate. This certificate is carried to the school where the child is given recognition for having a clean, healthy mouth. A record of the certificates issued is kept in the dental office for the use of the health department. The dentists have given freely of their time and have done a large amount of work for the indigent.

The teacher supplements her regular textbook lessons with various projects adapted and suited to her particular grade. These include poster making, toothbrush drills, dental health plays, stories, rhymes, songs, essay writing, multiple choice question tests and other methods. Two weeks after the examination, a follow-up letter is sent by the room teacher or school principal to those parents whose children have not had dental corrections completed. This is a form letter asking the cooperation of the parents in getting the dental defects corrected.

The examination is made in duplicate, the health department retaining one for its own files and follow-up work. The other, stating the necessity for and advantages of early attention and encouraging correction of defects through the

family dentist, goes to the parent over the health officer's signature as a notice of the dental defects found. Later, the nurse or health officer uses the duplicate examination blank in connection with routine home and school visiting. A health certificate is presented to each room in which every child has a clean healthy mouth. This certificate, which is attractively designed, states the reason for its presentation and bears the signature of the state health officer, the county health officer, and the superintendent of education. These certificates are usually presented during chapel. When several room certificates are awarded in one school, the presentation is usually preceded by an appropriate chapel program. Thus, we are able to attract parents and the leaders of the community to our activities. In the exercises, full recognition is given to the students and teachers.

Experience has shown that, in the promotion of a dental program, a well-organized parent-teacher association can render invaluable assistance. Accordingly, if such an organization is available, one of our first attempts is to get them to sponsor as well as assist in the project in a material way. The cooperation and financial support of various civic and literary clubs and, in some instances, of private individuals, Sunday school classes and church groups, have been received.

During the past two years, in nine counties, the work was promoted by two hygienists employed by the division. In these counties, we were able to do some intensive work, and because of closer observation, it was possible to secure more concrete achievements. For example, school examinations in three northern cities of the state in 1932 revealed that:

1. Huntsville had no school program. Of 3,103 pupils examined, 8 per cent showed no defects.

2. Gadsden had a limited school program. Of 4,471 examined, 13 per cent showed no defects.

3. Anniston had a yearly examination by dentists. Of 2,224 examined, 18 per cent showed no defects.

4. In Anniston, after three months' work by the hygienists, of 2,224 examined, 33 per cent showed no defects.

These findings indicate the value of a regular dental program, particularly when supplemented by the work of a hygienist.

DO YOU HAVE SOME PRACTICAL IDEAS?

IN times such as the profession is now experiencing, all have found it necessary to find new ways for conserving or rebuilding their practices, cutting expenses and making the best use of their greatly increased spare time. Undoubtedly, there are many who have developed and put into successful action ideas that would prove of great value to other members of the profession. Feeling that such must be the case and that a free exchange of practical ideas might prove beneficial, we are inviting our members throughout the country to send us any worth-while suggestions that they may have to offer. These we shall endeavor to publish in this section of THE JOURNAL from month to month.

The other day, information came to hand regarding an interesting and illuminating discovery made by one of our members in the East. This man had, up to about three years ago, the same idea that is held by many practitioners, i.e., that it is a waste of time to render service to children. At that time, since the number of his adult patients was not encouraging, he decided to include children in his clientele, giving careful attention to their needs and encouraging parents to bring their children to him. He now confesses that dental service for children is a practice asset and that, as a result of his efforts, he has been able to maintain a reasonable income level.

To many practitioners, the foregoing experience is not new. A fair analysis should convince one that if he can add a child patient here and a child patient there, from the families represented by his adult patients, he will decrease his leisure periods and increase his income. In addition, he will enhance the future prospects of his practice for many years to come. Before many years have passed, the satisfied child patient becomes the adult patient. Furthermore, the sympathetic and careful attention given a child frequently paves the way for patronage from the adult members of a family. Of course, such results are obtainable only in that type of service to the child which is in keeping with modern dental practice. The slipshod methods so frequently observed in the past would not be productive.

Another factor of the greatest importance in such a plan is education. In the past, too many have failed to give proper instruction and information to the patient in the chair. By this, we do not mean sales talks, but a practical type of instruction and information about the care of the teeth. Patients are deeply appreciative of such service. They need it and expect it. If it is not forthcoming, the patient may feel that the dentist is not interested in his welfare, and justifiably so. Besides the education of the patient at the chair, there should be an effort made to carry the message of mouth health to the public. This can be done in an ethical manner by lectures before school-child and adult audiences, by radio talks and by the use of motion pictures. The organization of community dental programs, especially in the schools, will aid materially in focusing the attention of parents and children on the care of the teeth. Also, cooperation and interest shown in the local health activities of the 4-H Clubs in May Day—National Child Health Day and the Summer Roundup of the School Child will surely bear fruit. We do not mean to leave the impression that such activity on the part of dental practitioners should smack of commercialism or selfish motives: such an approach to the education of the public would be destructive rather than constructive. Attention is merely called to the fact that while rendering the public a valuable service in furnishing information and active leadership in local health matters, we can logically expect a certain amount of response in return.

In the problem of educating the public and in organizing local dental activities, the Bureau of Public Relations of the American Dental Association can be of great service. The Bureau can furnish advice and suggestions for the proper initiation of such endeavors. It has available for sale a large variety of educational material, radio talks, etc. Its lantern slide lectures and motion pictures can be rented for a small fee.

It is hoped that these suggestions will prove helpful to our members and that these columns may become an avenue for the exchange of useful and worthwhile ideas. Everyone who has a prac-

tical idea or suggestion is urged to send it in that it may be passed on to the readers of THE JOURNAL. Address communications to The Bureau of Public Relations, American Dental Association, 212 East Superior Street, Chicago, Ill.

PHILADELPHIA DENTAL HEALTH CAMPAIGN AND EXHIBIT.

We are deeply interested in the idea that is being developed by the "annual meeting committee" of the Pennsylvania State Dental Society, the First District Dental Society, the Academy of Stomatology, the Eastern Dental Society, the North Philadelphia Dental Association of Dental Surgeons, the West Philadelphia Odontographic Society and the Pennsylvania Society of Dental Surgeons. In conjunction with the annual meeting of the Pennsylvania State Dental Society in Philadelphia, May 1-4, the meeting committee has seen fit to organize a dental health campaign and exhibit in that city which is to be given emphasis during the period of the meeting. The exhibit is to be very comprehensive in scope and will be designed primarily for the public, who will be urged to attend.

Each individual exhibit will carry placards giving authoritative sources for all statements made so that visitors may be impressed with the scientific basis of the exhibit. The following sections will be included:

1. Methods of maintaining and increasing dental health
2. Methods of preventing dental decay
3. Methods of eliminating dental diseases according to present day knowledge
4. The trend of dental research interpreted in such a manner as to be intelligible to lay persons
5. Sections devoted to the portrayal of the sequelae of neglect of oral hygiene
6. Methods of oral hygiene and the ends that these hope to attain
7. Bacteriologic reasons for mouth hygiene
8. The effects of oral disease on the body as a whole
9. Diet—what constitutes a so-called balanced diet; simple menus; special diet; vitamine contents of various foods; the effects of different diets on dental improvement in the light of present day knowledge

This is an idea that might well be copied by every state society in the country. It has been used to some extent by several of the state organizations from time to time, but it should become a regular practice at the time of all state meetings. The important thing is that the public is to be reached. Too often, when such exhibits are developed, the public is excluded. No society can contribute a greater benefit to the community honored by its convention than to develop a program and exhibit on dental health that will be available to laymen. It is the sort of effort that is far more effective than columns of newspaper publicity. In fact, it would be productive of newspaper comment that would be of much greater benefit to the dental profession than the usual publicity concerned with dental conventions. Of course, such an activity demands much time and labor. It requires careful thought and preparation. The committee in charge of such an endeavor must be carefully selected and the members must be willing to work and work hard.

The expressed hope of the organizations concerned that this dental health campaign and exhibit idea is to become an annual practice of the Pennsylvania societies is to be commended. It establishes a fine precedent, and valuable experience and the development of worthwhile exhibit materials will result. Certainly, it will aid materially in the education of the public and in elevating the profession in public esteem.

CURRENT LITERATURE

EXTRACTS AND ABSTRACTS

Partial Denture Design in Relation to Oral Health: Considerations of hygiene are of prime importance in partial denture restorations, according to J. H. Badcock (*D. Rec.,* December, 1932), taking precedence over those frequently emphasized principles of stress, balance and stability. Acknowledging that there are repercussions of mouth conditions throughout the body, and that the presence of food débris in contact with teeth causes caries, the operator continues to cover the gum margins and large surfaces of the teeth; the former causing or aggravating gingivitis; the latter causing caries. Many designs for dentures taught the student differ little or not at all from those of 1880. The "wire lower" of Neale represented the first step in applying the principle of minimum injury to the partial denture. The author applied the principle to the upper denture, calling attention to the fact that wherever a plate came in contact with the neck of a tooth a marginal gingivitis resulted. Twenty-one years' experience has strengthened that opinion and belief in the principle that plates should be so designed as to cover no more gum than is absolutely necessary and be cut away freely behind all natural teeth to allow friction from the food and tongue on the gum margin, which is the normal accompaniment of mastication. Cummer, Kennedy and Simms are quoted as agreed that the first essential in design of the partial denture is the necessity of keeping all parts from the free margin of the gum. Nevertheless, Simms only partially applies the principle advocated in his "Manual of Dental Prosthetics," showing many designs having no respect for gum margins. Wilson does not mention gum margins nor does Prothero, who shows many dentures of undesirable design in his "Prosthetic Dentistry." Cooper agrees with the principle in the *British Dental Journal,* 1929; but while it appears that most authorities are whole-hearted believers in the principle of free gum margins, some put the principle into practice to the fullest extent and others only partially, and a minority ignore it altogether. Increasing recognition of evils resulting from covering gum margins has led to advocacy of various types of skeleton plates. The author criticizes these designs as ignoring the need of adhesion or suction and recommends the use of dentures covering the palate and alveolar ridges, employing a suction disk if necessary. To avoid development of carious areas, clasps should be few and their area of contact small and they should entrap the minimum of food. A flat band fitted around a convex tooth will be in contact over a very small area, and where not in contact can be cut away. The surface which it touches will be clean. The more accurately the clasp is made to fit the convexity of the tooth, the smaller it need be, a mere line of contact in exactly the right place being the ideal. The narrow clasp accurately fitting the "bulge" of the tooth, correctly shaped and not extending to the gum will do the minimum of harm.

Treatment of Carcinoma of the Mouth: According to Charles L. Martin (*J.A.M.A.,* Nov. 5, 1932), surgical treatment of malignant conditions inside the mouth has afforded a relatively small percentage of cures (35 per cent according to one investigator), with mutilation the end-result. Irradiation, on the other hand, when successful, is devoid of danger and almost completely restores function. Successful results have been reported by various surgeons with implantation of gold radon seeds and by others with heavily filtered external contact applicators. In sections where radon seeds cannot be obtained, small (0.6 mg.) platinum needles can be employed in cancer of the cheeks, floor of mouth, inner lip and anterior portions of the tongue. They cannot be used in inaccessible locations such as the back of the tongue and the posterior nasopharynx. Local anesthesia is employed and care is taken to keep the needles in

normal tissue. When extension occurs on the hard palate or alveolar margin, it is sometimes necessary to augment the treatment with 25 or 50 mg. platinum radium capsuls held in contact with the lesion. Block dissection is not carried out routinely, but interstitial radiation is employed in the care of the neck with weak platinum needles. The white membrane which forms in about ten days desquamates in within four weeks, leaving a granulating surface. Healing is usually complete within ten weeks. Sloughing and painful reactions do not occur, scarring is slight and function usually is completely restored. Danger of infection is negligible if the mouth is kept clean. Two cases are reported, in the second of which a hard intra-oral ulcer had been treated as "trench mouth" until there was perforation to the outside. Inoperable squamous cell carcinoma was diagnosed. A combination treatment with radium needles, a radium capsul and roentgen rays resulted in healing. Rigid oral hygiene was a part of the treatment. The patient gained 10 pounds.

Dentist as Anesthetist: I should like to say something about the anesthetist as the surgeon or the surgeon as the anesthetist. There is considerable expression of conviction among many that the dental surgeon should not act as anesthetist on the case he is handling at the moment. To some extent that is true. There is undoubtedly a serious danger in losing oneself with difficulties and involvements of technique which may be ignored during such periods so that a patient may be carried too deeply beyond the zone of smooth respiration. Or again, and with perhaps equal personal embarrassment, the patient may pass out of profound anesthesia to light anesthesia with body movements which impede the completion of the task. But, much as I think it sound practice to have an assistant to administer the anesthetic gases and watch the patient's condition during the period of unconsciousness, I feel that there is no need for us as dental surgeons to disregard the responsibilities of the narcosis, and place the onus completely on the shoulders of the assistant. The vast majority of our office anesthesias are of comparatively brief duration, and with one's ear attuned to the patient's respiration and a glance at the color of the skin, the mucosa, or the blood, the operator certainly can and should suggest to the assistant, alterations in the gas flow as they seem indicated. This is especially so in instances wherein the respiration becomes labored owing to technical conditions arising out of the operator's own procedures. I refer to obstructions of the oropharynx from gauze crowding, or from leaky curtaining permitting débris and blood and mucus to choke off the free airway. How can the assistant see what the surgeon is doing back in the throat? I maintain these are the operator's responsibilities and we should expect of our assistants rigid watchfulness as to the technical factors of gas delivery, inhaler seating, retraction of cheek and lips, sponging of blood at the site of involved surgery, and maintenance of unimpaired airway by holding the chin up. The physiologic factors must be chiefly borne in mind by the operator. He must realize that he is himself possibly causing the irregularities and it is he and not the assistant who can correct them. Incidentally, while on the subject of the assistant, it would be well to give heed to his or her value in curtaining off the throat effectively. The assistant should hold a tongue depressor against the throat sponge so that the oropharynx is occluded so far as ingress of air through the mouth is concerned, and the tongue is not pushed back or down too far. As far as the tongue depressor is concerned, I use it because of its blade and convenient handle and not because of its design to depress the tongue.—M. H. Feldman, in *Cur. Res. Anes. & Anal.*, January-February, 1933.

Prevention of Rickets: The prevention of rickets is a very live question in spite of the fact that with direct irradiation, ultra-violet rays, cod liver oil or its concentrates, haliver oil, viosterol, activated milk, etc., we have more specifics for it than for any other single disease. It is, however, extremely prevalent, even in quarters where it would be least suspected. There is a growing feeling that some form of antirachitic milk is the best preventive as well as curative, since it has the marked advantage of a high content of calcium and phosphorus. Another point which has been brought out before, but was emphasized by several speakers in the recent symposium at our sixty-first annual meeting, is that the results of standardization of antirachitic agents as units per c.c. or per quart, does not accord with clinical experience. Much more viosterol is needed to protect infants than would be expected from the assays on rats. Several of the speakers, led by Hess, pointed this out. There is no doubt

that the estimation of human dosage on the basis of rat assays is fallacious when compared with clinical results, though until the work of Hess and Lewis appeared, these biological assays entirely overshadowed clinical data, which after all constitute the essential criterion. There are a number of ways of increasing the antirachitic potency of milk. One which seems to be favored by Hess above others is the feeding of activated yeast to the milch cows. He considers it especially applicable to certified dairy farms, since one can be sure of the quality of the yeast used, the ration fed, and frequent biological assays of the milk. For the general supply of large communities, the method does not seem applicable at present. However, irradiation of the milk can be carried out at a central station. An exposure of 16 seconds to certain carbon arc rays is sufficient for the purpose, and this does not develop any bad odors or tastes, nor are the vitamins injured. Extensive experiments over two winters in New York have shown that such irradiated milk will prevent rickets practically without exception, even in negro infants, who are particularly susceptible. The amount of milk fed these infants was only two-thirds quart daily instead of the quart usually recommended. Hess further points out that laboratory experiments show that a greater number of antirachitic units are required when viosterol is given than when cod liver oil is used, and has suggested that in addition to vitamin A, cod liver oil contains something of value against rickets which is not present in irradiated ergosterol. He believes that we should be guided by the clinical activity of our antirachitic agents instead of depending too much upon the laboratory assay. He supports strongly the use of activated milk, fluid or dry, since it has the advantage of providing an automatic method for the prevention of rickets, supplies the essential factor in a medium rich in phosphorus and calcium, and the results are obtained by means of an exceptionally small amount of the antirachitic factor. Another paper given in the symposium reported on milk irradiated with carbon arc lamp, milk from cows fed irradiated yeast and from cows irradiated directly with the carbon arc lamp. The results were closely comparable with these outlined by Hess. . . . Another paper in the symposium gave the results of experiments which have been going on at Columbia University for several years; namely, the purification and improvement of a concentrate from cod liver oil which contains the antirachitic element. . . . Only fifteen experiments on rachitic infants have been carried out by this method so far, but the results were entirely favorable and comparable to those obtained by a dosage of three teaspoons per day of cod liver oil.—Editorial, *Am. J. Pub. Health,* January, 1933.

Anesthesias: A word of caution might here be added concerning the dangers from a too ready acceptance for general trial and use of new drugs and anesthetic agents which continually spring up under the sponsorship of commercial houses. How often do such drugs make their appearance, how enthusiastically are their supposed advantages noised about, yet how frequently does a chain of fatalities follow their use, fatalities but slowly reported until finally a wave of certainly resultant deaths sweeps the dangerous product from the market? New drugs and advances are ever welcome; but should our employment of them not await a verification of their merits by a dependable research hospital rather than to rest solely upon the claims of those commercially interested or of enthusiasts directly connected with their acceptance and adoption? . . . . The problem of lowering anesthetic death rates is primarily one for the anesthetist to solve. But the solution cannot satisfactorily be reached without the cooperation of the surgeon. It should be determined that every aid be given in the creation, in all hospitals, of adequate departments of anesthesia; that vigorous efforts be made to see that these are headed wherever practical by trained physician anesthetists; and that rights and authorities compatible with their importance in surgical work be granted to these specialists. The figures of this survey clearly demonstrate to the surgeon that his own best interests, as well as those of his patients, lie in this direction. Complete cooperation should be guaranteed to the surgeon's colleague, the trained physician anesthetist, who, by a wise selection of drugs and methods, works toward the common end of saving the lives of those who submit to operation.—Edward M. Livingston, in *Am. J. Surg.,* January, 1933.

MISCELLANY

BOOK REVIEW

An Experimental Investigation of Enamel, Dentine and the Dental Pulp. By E. Wilfred Fish, D.Sc., M.D., L.D.S. Published by John Bab, Sons & Danielsson, Ltd., 83-91 Great Titchfield Street, W. 1., London.

This volume is a corroborative and illuminating one. Likewise, it is a precise piece of research. The investigation indicated is carried out with such detailed care, such logical sequence, that the reader's confidence, stimulated at the beginning, grows undisturbedly to the end. The sporadic writings on permeability, saturability, the nutritional system of dental tissues *et al* that have appeared in recent years have in this book an elucidation beyond cavil; also changes in those tissues under artificial and pathologic injury.

The investigation is a definite contribution to our knowledge, an approval and a disproval of many pronouncements published in the past. Also it is written with such clarity that reading it is a pleasure. A scientist may well be happy to have the volume and a practitioner might be sure the volume was written for him.

The chapter headings intimate fully enough the interesting content without further discussion.

I. The Vitality of Enamel.

II. Tissue Fluid in the Dentine.

III. Metabolic Changes in the Dentine.

IV. The Reaction of the Dentine to Experimental Peripheral Injury.

V. The Reaction of the Dental Pulp to Experimental Peripheral Injuries of the Dentine.

VI. On the Pathology of the Dentine and the Dental Pulp.

The appendix contains two quotations, one from "The Natural History of the Human Teeth" by John Hunter and one from "Dental Physiology and Surgery" by John Tomes.

Eight color plates and fifty-one black and white illustrations accompany the work. The fact that they are located at the end of the treatise presents a minor inconvenience to the reader, but their definiteness is a satisfying compensation for the trouble of turning to them.

N. G. T.

CONGRESS VISITORS TO VIEW WONDERS OF SCIENCE AT CHICAGO'S WORLD'S FAIR

Of particular interest to the thousands of dentists and their families who will attend the Chicago Centennial Dental Congress will be the majestic Hall of Science, one of the largest and most important structures of A Century of Progress International Exposition. The Congress, in conjunction with which the Diamond Jubilee of the American Dental Association will be held, will convene at the Stevens Hotel, August 7 to 12, inclusive. Of course, there will be a host of other important buildings and exhibits on the exposition grounds, but to the man or woman engaged in any branch of the healing arts, the Hall of Science will have a peculiar and compelling interest.

While every phase of scientific achievement within the last one hundred years will be presented in this magnificent building, the dental exhibit will naturally be the magnet to the dentists gathered in Chicago for the greatest dental meeting of all time. Three long years of thought, time and energy, and $40,000.00, were spent in the planning of dentistry's pageant of progress which will be viewed by the more than 50,000,000 visitors who are expected to attend the Fair. Certainly it cannot be denied that A Century of Progress International Exposition has provided the dental profession with the greatest opportunity for public education ever made possible.

The architecture of each building is unique and yet is in complete harmony with all other buildings on the grounds. An outstanding feature of the Hall of Science is the tower where chimes have been installed. The building is almost 800 feet long and 300 feet wide. The great hall which it contains is 250 feet in length and 60 feet wide, with a ceiling 57 feet high. On the walls of this room, tribute will be paid to the torch bearers of science by inscriptions setting forth some of their names and principal achievements.

So far, we have made mention only of the dental exhibit. A large section of the available space will be devoted to medical exhibits, also of fundamental interest to every dental practitioner. The principal theme, of course, will be the vital and educational presentation of the progress of medicine in its unrelenting war against disease. Many world-famous medical centers and institutions such as the Pasteur Institute of Paris, the Koch Institute of Berlin, the Deutsches Museum of Dresden, the Wellcome Museum of London, the Liverpool School of Tropical Medicine and the Mayo Clinic of Rochester have collaborated in building the medical exhibits. The American Medical Association and the American Pharmaceutical Association will also play an important part in telling the story of medical progress.

One striking feature of the medical exhibit will be the transparent man, a model of the human body, heroic in size, showing with remarkable clarity the skeletal, nervous, vascular, respiratory, digestive and muscular systems. The observer, by means of the model of the transparent man, visualizes human anatomy as though his eyes possessed the penetrating power of roentgen-rays. The locations of the interior organs of the human body are shown by electrical illumination, and the relations of these organs to the different parts of the transparent skin are readily apparent.

It is planned that visitors to the exposition may participate in demonstrations of human anatomy and physiology by means of models put into action by the observer. By the mere pressing of electrical switch buttons or the turning of levers, one may study the circulation of the blood; the action of the heart valves; the various types of vocal cords that produce the soprano, alto, tenor and bass voices; the action of the lungs in breathing; the structure of the eye and many other bodily activities.

In addition to the medical and dental displays, there will also be an exhibit in the basic sciences, such as biology, chemistry, geology, mathematics and physics. These are undoubtedly the most difficult of portrayal, and yet a preview of these exhibits will prove that they are striking and will give the visitor a lasting and valuable impression of the basic sciences themselves and their relation to medical and industrial progress.

With this brief sketch of the drama as it is to be portrayed at the Hall of Science, it is hoped that some conception will be had of the scope and magnitude of A Century of Progress Exposition. As all other fields of human endeavor will be accorded the same treatment, a visit to it will constitute a liberal education. What A Century of Progress is to the public in general, the Chicago Centennial Dental Congress is to the dental profession. Just a few more months and the curtain will rise on the greatest educational entertainment offering of our times.

Every member of the American Dental Association, his family and friends will be accorded a hearty welcome. Plan now to include Chicago and the Centennial Dental Congress in your 1933 vacation itinerary.

MAY DAY—CHILD HEALTH DAY IN 1933

Some special activities suggested for May Day—Child Health Day in 1933 by the American Child Health Association are the following:

Campaign to maintain good nutrition.

Immunization against diphtheria and vaccination against smallpox for preschool children.

Examination of preschool children and correction of defects before children enter school; promotion of the "Summer Round-Up."

Inventory of the health facilities of the community.

Analysis of community child health needs, to make them known to the public.

Community plans for meeting these needs.

Stimulation of community parent education programs.

Encouragement and assistance to communities in assuming responsibility for their own child health work.

Campaign for official registration of all births.

Plans for the use of open spaces in the neighborhood for inexpensive recreation: fields for baseball, football and hockey; public tennis courts; pools for swimming, wading and winter sports. Encouragement of hiking, with opportunity for cooking over camp fire.

Opening of gymnasiums and swimming pools so that they may be used to capacity by the community.

In addition, it is suggested that county medical and dental societies choose a representative to serve on the local May Day Committee and to cooperate in working out plans for the community program, this representative to explain the plans to the society which he

represents and find out what part the society can take in the program; choose members to continue cooperation through the year in attaining the May Day objective, and others to constitute a speakers' bureau, to be available on request, for addressing lay groups on health subjects in connection with the May Day objective.

CORRESPONDENCE

The Report of the Committee on the Costs of Medical Care

To the Editor:

There are two important ideas, definitely inferred if not so expressed, in the majority report of the Committee on the Cost of Medical Care which need further questioning and consideration from the dental practitioner's viewpoint: (1) that the low wage earner is unable to meet the cost of dental care and (2) that his dental needs are inadequately supplied. To assume that his oral health is neglected is to assume correctly, but to assume that the low wage earner would avail himself of the necessary dental treatment, yet does not, because of the cost, seems a fictitious premise on which to have carried out this extensive investigation. Had the committee given the attitude of the low wage earner further consideration, the conclusions arrived at might have been radically different, for the mental attitude toward dental service is a greater deterrent than is the consideration of cost.

The committee apparently overlooked the fact that the low wage earner and his dependents, through necessity and by a process of adjustment, accommodate themselves to a standard of living commensurate with his earnings, and after paying for basic needs in the way of food, shelter and clothing, inferior as they may be, there still is a surplus which he can draw on for his medical and dental care.

I am not referring to the unemployed low wage earner, who is now unable to pay for his basic needs, in full or in part. Since he has no surplus, he must of necessity depend on charitable organizations for medical and dental treatment.

Who is the low wage earner? He is almost everybody, in times not only of depression, but also of prosperity. He belongs to that group of people which outnumbers any other group by a vast majority, and statistics show that the greatest combined purchasing power is in the hands of that group. It is the low wage earner who needs health service and special consideration according to the majority and minority reports of the Committee on the Cost of Medical Care, the assumption being that he cannot afford to pay for such services. But does he need defense on pecuniary grounds?

There should be no question as to whether he can afford dental service since he demonstrates his purchasing ability by the use of his surplus for the buying of candies, cigarets, cosmetics, beverages, entertainment, knickknacks from the "five and ten" cent stores and many unessential wares from the mail order houses and department stores. If the healing science must concern themselves with general economics, and the economics of their patients in particular, it is of greater importance to determine what percentage of the low wage earner's surplus ought to be spent for health care than to question his ability to pay for them at all. Where, therefore, in his list of expenditures, should medical and dental care belong? Notwithstanding the fact that some of these trivial purchases bring happiness to many a drab existence, health care is of greater importance and should take precedence on the list.

The total amount spent yearly for medical and dental care is very small in comparison with the amount spent for nonessentials. The low wage earner continues spending his surplus indiscriminately, and thus, when he becomes ill, suffers pain and is unable to work, he finds himself without the necessary reserve funds to meet the expense of professional care. Owing to his former indiscreet spending and his present shortage, any fee, large or small, is a burden to him. This burden would be lightened considerably, if less were spent for unnecessary things, costing little per purchase, but much in the aggregate; and if those small sums were saved daily for medical and dental services. If billions can be mustered for nonessentials, surely sufficient funds can be found for the health preserving services of medicine and dentistry.

Therefore, in the most humble circumstances, a sum sufficient to pay for the extraction of all abscessed teeth and the restoration of some of the carious teeth of the low wage earner and his family could be saved, but since he does not understand nor take mouth health seriously, it is questionable whether he would follow a program which may seem to him absurd and unnecessary. On offering such suggestions, social service workers and others engaged in spreading the gospel of

good health learn, as most practicing physicians and dentists have learned, that the cost is not so much an obstacle as is fear, ignorance of health matters and disbelief in the need for early medical and dental attention. Will a solution of his dental cost problem remove these obstacles? He may be truthful in lamenting the lack of money for dental needs, but, at the same time, he continues spending for other purposes, just as he has done heretofore, and thus an accumulation of any reserve for dental services becomes impossible.

The unpredictability of the time of arrival, severity and frequency of disease has often been used as an excuse for this unpreparedness. True, when disease strikes hard and often or when caries is rampant, and the necessary funds are not available, the professional fees seem "too high," and the low wage earner lets himself feel that he is a victim of the "medical trust." Though he dislikes to, he must learn that disease and accidents are inevitable, teeth will decay, babies will be born, childhood diseases will occur and so he must, in his healthier and carefree days, save part of his surplus for such exigencies, by refraining from thoughtless spending. This saving process is an economic form of insurance against disease cost.

He should learn that eternal vigilance is the price of good health, as he should also learn to be charitable in his views toward those who often render him aid and charity in sickness, and he should not deliberately minimize the value of the medical or dental services rendered, in order to justify himself in the delay or indefinite postponement of payment for such services. He should learn not to expect free professional services at all times because, on former occasions, he obtained them at charitable institutions. He should learn to consider the professional man as less mercenary than those in other walks of life, and yet, like the laborer, worthy of his hire. He should learn that a paternalistic or a privately controlled business organization engaged in health services may be associated with more evils than those he resents now and to "bear those ills we have" rather than "fly to others we know not of." Since the uninformed low wage earner is inclined to regard dentistry as a mercenary enterprise, chiefly concerned with "pulling and filling" teeth, the cost of dental care looms largest in his mind. Having learned that extracting and filling are incidental and that dentistry is concerned particularly with the preservation of general health through attention to mouth health, he will of his own desire, seek adequate dental care and solve the cost problem himself as he solves his other cost problems. To my mind, the reason the low wage earner's dental needs are not adequately supplied is ignorance of, and mental antagonism toward, dental service, fear of dental operations, failure to realize the importance of oral hygiene and its relationship to general health, lack of understanding of the need for preventive treatment, skepticism as to advice given in the dental office and prejudices arising from erroneous information received outside the dental office.

It would seem, therefore, that even if a system of voluntary or compulsory health insurance, with the cost reduced, were put in operation, the lack of cooperation, together with an unfriendly attitude toward dental services, would still prevent the low wage earner from securing adequate dental care. While study and investigation regarding this mental attitude are indicated, a system of dental health education may be the solution.

HENRY REISEMAN,
5203 West Twenty-Fifth Street,
Cicero, Ill.

NEWS

Dentists' Group Aiding Salvation Army Campaign: Martin Dewey of 17 Park Avenue, Past President of the American Dental Association and member of the New York State Dental Society and the First District Dental Society, has accepted the chairmanship of the Dentists and Dental Supplies Division of the Salvation Army United Appeal's Trade & Industry Committee, according to an announcement by Thomas J. Watson, president of the Merchants Association and Chairman of the Committee. Active solicitation in the campaign will begin April 3, according to Mr. Watson. The Salvation Army is seeking $1,110,000, of which $565,000 is needed to continue emergency relief activities, such as free food stations, shelters, family welfare bureaus and employment services, and $545,000 for the maintenance of institutions which include homes and hospitals for women and children, day nurseries and fresh air camps.

Krupp Dental Clinic Thirty Years Old: The Krupp dental clinic at Essen looked back on thirty years of existence, Jan. 2, 1933. It was the first clinic sponsored by an industrial enterprise in Germany, and was created by

F. A. Krupp as an institution of charity. Under its first manager, Prof. Dr. J. Witzel, the clinic soon attained an important position, and the present director, Dr. F. Hauptmeyer, has seen the fame of the clinic grow far beyond the frontiers of Germany. At present, it ranks among the best equipped clinics for mouth and jaw diseases. The clinic and Dr. Hauptmeyer have earned special merit through the introduction of Krupp noncorrosive steel into dentistry.

Dr. Winter Wins Jenkins Medal: George B. Winter, of St. Louis, Mo., teacher of exodontia at the Washington University School of Dentistry, has been awarded the N. S. Jenkins medal for distinguished service for the year 1932. The award follows the completion of a piece of research on impacted third molars.

Dentists: Delegation of Professional Duties: The plaintiff in this case sued the defendant, a dentist, for the return of fees paid for a set of false teeth that he contended did not fit him. He further contended that his contract with dentist had a personal element in it that could not be assigned, such as has a contract with a surgeon engaged to perform an operation, but that the dentist did assign a part of the duties involved in making the plate. A dentist, says the Supreme Court of Kansas, does not impliedly warrant to his patient that he himself will do all the work involved in the construction of a set of false teeth. The court will take judicial notice of a common practice in the dental profession for a dentist to take the impression of a patient's jaw and do all things that have to do with the fitting of teeth in the mouth, and then to send the plate to what is known as a mechanical dentist for vulcanizing and polishing. Furthermore, continued the court, the analogy presented by the plaintiff would be more nearly correct if the dentist were compared with one who prescribes glasses for a patient and then sends the prescription to an optical company, equipped with the machinery to grind the lenses according to the prescription. The fact that a dentist constructs one set of teeth that does not fit the patient and then constructs a second set which does not fit on the first trial in the patient's mouth does not entitle the patient to sue for a return of the fee paid to the dentist for constructing the teeth. The patient must accord the dentist a reasonable opportunity to fit him. What constitutes a reasonable opportunity must depend on the facts and circumstances of each individual case and is for the jury to determine. Sometimes a defect may be corrected by a little filing away of a place where the plate rubbed the gums. Sometimes the teeth can be filed and made to fit. Sometimes plates can be filled up a little in some place so that they will fit. Any of these things might be done in a few minutes. It would be a harsh rule that would deprive a dentist of pay for his services on account of defects which could be remedied by a few moments' work. The judgment of the trial court for the dentist was affirmed.—Medicolegal, *J.A.M.A.*, Jan. 14, 1933.

Deaths

Baker, Edward R., Erie, Pa.; Baltimore Dental College, 1896; died, November 14; aged 60. Dr. Baker practiced in Smethport, Pa., until 1908, when he moved to Erie, Pa. He is survived by the widow and four sons, Edward R., Henry A., and Charles M. being in dental practice in Erie.

Boon, W. O., Portland, Ore.; North Pacific College of Oregon, School of Dentistry, 1907; died, December 29. The widow, two daughters and three sons survive.

Cauch, Walter A., Berkeley, Calif.; College of Physicians and Surgeons of San Francisco, A School of Dentistry, 1916; died, December 14; aged 39. The widow and two sons survive.

Chamberlain, W. A., St. Louis, Mo.; University of Michigan College of Dentistry, 1898; died, February 13.

Firkins, A. M., Compton, Calif.; Northwestern University Dental School, 1910; was killed in the recent earthquake in southern California, March 10; aged 47.

Frangenheim, Raymond R., Maywood, Ill.; Northwestern University Dental School, 1924; died, February 15, after an operation for appendicitis; aged 32. The widow and two daughters survive.

Gilbertson, James Coolidge, Oakland, Calif.; Temple University School of Dentistry, 1897; died, December 19; aged 56. The widow, a son and a daughter survive.

Holbrook, C. S., Shelby, Ohio; died, February 17; aged 79. Dr. Holbrook was the oldest practicing dentist in Rochland County, Ohio, having been in active practice for fifty-eight years. Surviving are the widow and four daughters.

Nottage, George, Portland, Ore.; Thomas

W. Evans Museum and Dental Institute School of Dentistry, University of Pennsylvania, 1900; died, December 26; aged 55. Dr. Nottage was a past president of the Oregon State Dental Association and at one time a member of the faculty of the North Pacific College of Oregon, School of Dentistry. The widow survives.

Robinson, Frank, Wabasha, Minn.; University of Minnesota, College of Dentistry, 1929; died, from injuries received in a motor accident, December 25; aged 26. Dr. Robinson was secretary of the state board of dental examiners and active in the state dental organization. He is survived by his mother, two sisters and two brothers.

ANNOUNCEMENTS*

CALENDAR OF MEETINGS

American Dental Association in conjunction with the Chicago Centennial Dental Congress, Chicago, Ill., August 7-12.

American Academy of Periodontology, Chicago, August 3-5.

American Board of Orthodontia, Oklahoma City, Okla., April 17-18.

American Dental Society of Europe, Le Touquet, France, April.

American Society of Oral Surgeons and Exodontists, Chicago, August 4-5.

American Society of Orthodontists, Oklahoma City, Okla., April 19-21.

Alumni Society of Philadelphia Dental College and Dental School of Temple University, Philadelphia, May 1.

Dental Alumni Association of American University of Beirut, Syria, June.

Eastern Association of Graduates of Angle School of Orthodontia, New York City, May 1-2.

Fédération Dentaire Internationale, Edinburgh, July 22-27.

Society for Advancement of General Anesthesia in Dentistry, New York City, third Monday in February, April, October and December.

St. Louis University Dental Alumni Reunion, St. Louis, Mo., March 31-April 1.

National Association of Dental Examiners, Chicago, August 7.

Ontario Dental Association, Toronto, May 15-18.

American Dental Assistants Association, Chicago, August 7-12.

American Dental Hygienists' Association, Chicago, August 7-12.

Dental Hygienists Association of State of New York, Syracuse, May 11-13.

STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

April

Alabama, at Birmingham (24-26).
California (State), at Del Monte (20-22).
Connecticut, at Bridgeport (19-21).
Kansas, at Topeka (24-26).
Kentucky, at Louisville (3-5).
Louisiana, at New Orleans (27-29).
Michigan, at Grand Rapids (10-12).
Montana, at Billings (20-22).
New Jersey, at Atlantic City (26-28).
Oklahoma, at Oklahoma City (17-20).
Tennessee, at Knoxville (27-29).
Virginia, at Richmond (24-26).

May

Illinois, at Peoria (9-11).
Indiana, at Indianapolis (15-17).
Iowa, at Des Moines (2-4).
Maryland, at Baltimore (1-4).
Massachusetts, at Boston (1-4).
Missouri, at St. Louis (15-17).
Nebraska, at Omaha (15-18).
New York, at Syracuse (11-13).
North Dakota, at Valley City (16-17).
Pennsylvania, at Philadelphia (2-4).
South Carolina, at Columbus (22-23).
Texas, at San Antonio (9-11).
Vermont, at Burlington (17-19).
West Virginia, at Charleston (15-17).

June

Arkansas, at Little Rock (5-7).
California (Southern), at Los Angeles (5-7).

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

Colorado, at Colorado Springs (19-21).
Georgia, at Savannah (12-14).
Maine, at Rangeley Lake (22-24).
Mississippi, at Gulfport (15-17).
Nevada, at Reno (3).
New Hampshire, at North Conway (1-2).
North Carolina, at Chapel Hill (6-8).
Oregon, at Portland (21-24).
South Dakota at Watertown (26-27).
Utah, at Ogden (1-3).
Washington, at Yakima (June 30-July 2).
Wyoming, at Laramie (June 30-July 1).

STATE BOARD OF DENTAL EXAMINERS

Alabama, at Birmingham, June 26. E. W. Patton, Secretary, Comer Bldg., Birmingham.

Arkansas, at Little Rock, June 19-22. Clarence W. Koch, Secretary, Donaghey Bldg., Little Rock.

California, at San Francisco, May 22, and Los Angeles, June 19. K. I. Nesbitt, Secretary, 450 McAllister St., San Francisco.

Connecticut at Hartford, June 28-July 1. Almond J. Cutting, Recorder, Southington.

Florida, at Jacksonville, June 21. R. P. Taylor, Secretary, Jacksonville.

Georgia, June 1. R. C. Coleman, Secretary, Atlanta.

Indiana, at Indianapolis, June 14. J. M. Hale, Secretary, Mt. Vernon.

Iowa, at Iowa City, May 29-June 1. Hardy F. Pool, Secretary, Mason City.

Kentucky, at Louisville, June 7-10. Robert L. Sprau, Secretary, 970 Baxter Bldg., Louisville.

Maine, at Augusta, June 26-28. Alton H. Swett, Secretary, 192 State St., Portland.

Massachusetts, at Boston, June 13-16. W. Henry Grant, Secretary, State House, Boston.

Mississippi, at Jackson, June 20-23. T. Ford Leggett, Secretary, Laurel.

New Jersey, at Trenton, June 26-July 1. John C. Forsyth, Secretary, 148 W. State St., Trenton.

Pennsylvania, at Philadelphia and Pittsburgh, June 21-24. W. A. McCready, Secretary, Highland Bldg., Pittsburgh.

Rhode Island, at Providence, June 27-29. Albert S. Midgley, Union Trust Bldg., Providence.

Texas at Dallas, June 12-15. A. L. Nygard, Secretary, Medical Arts Bldg., Dallas.

Vermont, at Montpelier, June 26-28. H. B. Small, Secretary, Burlington.

Virginia, at Richmond, June 13. John M. Hughes, Secretary, Medical Arts Building, Richmond.

Wisconsin, at Milwaukee, June 12-16. S. Donovan, Secretary, Tomah.

WISCONSIN STATE BOARD OF DENTAL EXAMINERS

The Board of Dental Examiners of the State of Wisconsin will conduct an examination at Marquette University Dental Department, Milwaukee, June 12-16. Credentials of all applicants must be in the office of the secretary June 5.

S. F. Donovan, *Secretary*
Tomah

WYOMING STATE DENTAL ASSOCIATION

The annual meeting of the Wyoming State Dental Association will be held in Laramie, June 30-July 1.

E. C. Andrew, *Secretary*
Cheyenne

STATE OF RHODE ISLAND BOARD OF REGISTRATION IN DENTISTRY

A meeting of the Rhode Island Board of Registration in Dentistry for the examination of applicants for license to practice dentistry and dental hygiene will be held at the State House, Providence, June 27-29, beginning each day at 9 a. m. Candidates shall present to the secretary of this board at least one week before the examination an application with fee and photograph. For applications and further information, address

Albert L. Midgley, *Secretary*
Union Trust Bldg.
Providence

BOARD OF DENTAL EXAMINERS OF ALABAMA

The Board of Dental Examiners of Alabama will conduct its next annual dental and dental hygiene examinations in Birmingham, beginning at 8:30 a.m., June 26. Failure to forward all credentials to the secretary-treasurer's office at least two weeks before the date of the commencement of examination will have the effect of barring the applicant from examination. For further information, address

E. W. Patton, *Secretary*
Comer Bldg.
Birmingham

TEXAS STATE BOARD OF DENTAL EXAMINERS

The Texas State Board of Dental Examiners will meet in Dallas, June 12-15, at Baylor Dental College, to examine applicants for license to practice dentistry. All applications accompanied by examination fee of $25 must be in the hands of the secretary at least ten days before the meeting. For further information, address

A. L. NYGARD, *Secretary*
Medical Arts Bldg.
Dallas

SOUTH DAKOTA STATE DENTAL SOCIETY

The fifty-first annual session of the South Dakota State Dental Society will be held in Watertown, June 26-27.

ERNEST W. ELMEN, *Secretary*
Sioux Falls

THE CONNECTICUT DENTAL COMMISSION

The Connecticut Dental Commission will meet in Hartford, June 28-July 1, for the examination of applicants for license to practice dentistry and dental hygiene. Applications should be in the hands of the recorder at least ten days before the meeting. For application blanks and further information, apply to

ALMOND J. CUTTING, *Recorder*
Southington

MISSISSIPPI DENTAL ASSOCIATION

The annual meeting of the Mississippi Dental Association will be held in Gulfport, June 15-17.

M. L. JONES, *Secretary*
Meridian

NEW JERSEY STATE DENTAL SOCIETY

The sixty-third annual session of the New Jersey State Dental Society will be held April 26-28, at the Hotel Ambassador, Atlantic City. Clinical data can be secured from J. R. K. Moodey, 42 Park Place, Morristown. For exhibit space, consult E. L. D. Hester, 34 East Palisade Ave., Englewood.

F. K. HEASELTON, *Secretary*
223 East Hanover St.
Trenton

PENNSYLVANIA STATE DENTAL SOCIETY

The Pennsylvania State Dental Society will hold its sixty-fifth annual meeting at the Bellevue Stratford Hotel, Philadelphia, May 2-4. In addition to the program of essays, a series of clinics will be presented by a group of medical men demonstrating medical and dental cooperation in the treatment of patients, and a dental health exhibit will be open to the public.

J. A. SALZMANN, *Chairman*,
Publicity Committee,
Ludlow Bldg.
Philadelphia

ARKANSAS STATE BOARD OF DENTAL EXAMINERS

The next examination of applicants to practice dentistry in Arkansas will be held at the Marion Hotel, Little Rock, June 19-22; fee, $35. Applications must be filed at least ten days prior to date of examination. Address all communications to

CLARENCE W. KOCH, *Secretary*
Donaghey Bldg.
Little Rock

MISSISSIPPI STATE BOARD OF DENTAL EXAMINERS

The annual meeting of the Mississippi State Board of Dental Examiners will be held in the capitol, Jackson, June 20-23. Applicants should secure application form and information from the secretary and have form properly executed at least ten days prior to the examination.

T. FORD LEGGETT, *Secretary*
Laurel

AMERICAN ACADEMY OF PERIODONTOLOGY

The fifteenth annual meeting of the American Academy of Periodontology will be held at the Stevens Hotel, Chicago, August 3-5. All ethical dentists, whether members of the Academy or not, are cordially invited to attend this meeting.

CLAYTON H. GRACEY, *Secretary*
Fisher Bldg.
Detroit

AMERICAN SOCIETY FOR THE ADVANCEMENT OF GENERAL ANESTHESIA IN DENTISTRY

The next meeting of the American Society for the Advancement of General Anesthesia

in Dentistry will be held April 24 at the Barbizon-Plaza Hotel, New York City; dinner, 7 p. m., scientific meeting, 8:15 p.m.

LEONARD S. MORVAY, *Secretary*
76 Clinton Ave.
Newark

CLASS OF 1923, N. Y. U. COLLEGE OF DENTISTRY

(Change of Date)

The class of 1923, N. Y. U., College of Dentistry, will celebrate its tenth anniversary with a reunion dinner at the Fraternity Club Bldg., May 5.

MAX J. FUTTERMAN
2090 Bryant Ave.
Bronx, New York City

CLASS OF 1923, COLLEGE OF DENTAL AND ORAL SURGERY

The class of 1923, College of Dental and Oral Surgery, will celebrate its tenth anniversary with a dinner, May 25, at 7. p.m. Members of the class who have not received notice of this meeting are asked to forward correct address to

SIDNEY E. RIESNER
120 East Thirty-Ninth St.
New York City

EXAMINATION FOR APPOINTMENT IN THE DENTAL CORPS, U. S. ARMY

The War Department has made the following announcement:

"Appointment of officers in the Regular Army.—1. An examination of applicants for appointment as first lieutenants, Dental Corps, Regular Army, under the provisions of AR 605-15, will be held within the continental limits of the United States from April 17 to April 22, 1933, inclusive.

2. Applications and requests for information concerning this examination should be addressed to The Adjutant General."

There are two vacancies in the Dental Corps and there are approximately 150 approved applicants who will be invited to take the examination. The War Department has requested that all applicants be informed that there is no assurance of their appointment in the Dental Corps in the event of a successful examination.

Examinations will be held at Washington, D. C., Denver, Colo., San Francisco, Calif., and San Antonio, Texas.

In order to be eligible to take this examination the applicant must be a citizen of the United States; a graduate of a recognized dental school; in good standing in his profession; between the ages of 22-6/12 and 31-9/12 years at the time of examination; and must have been engaged in the practice of his profession for at least 1-11/12 years subsequent to graduation.

NEW YORK INSTITUTE OF CLINICAL ORAL PATHOLOGY

The New York Institute of Clinical Oral Pathology, Inc., was organized recently for the purpose of holding monthly conferences from October to May, when cases are presented and reported and also a lecture is given.

The institute maintains a pathologic laboratory for the complete study of interesting cases in this field. The institute is also to act as a registry for as many cases as possible so that members may use these collected cases for the purpose of special study.

The institute is incorporated in the State of New York and is to be active all over the United States. The main support is derived from contributions by a small group of professional men and benefactors. Membership is limited to one hundred (general medical and dental practitioners and all specialists interested in this field).

The advisers of the Institute are Abraham Flexner, James Ewing, Harlow Books and George H. Semken. Fred W. Stewart is consultant pathologist and Lester R. Cahn pathologist.

Further information may be obtained from the secretary, 101 East 79th Street; tel. Butterfield 8-2858.

THEODOR BLUM, *Secretary*

RECENT BOOKS WORTH BORROWING* OR BUYING†

from the

LIBRARY BUREAU

of the

AMERICAN DENTAL ASSOCIATION

212 E. Superior St., Chicago, Ill.

	Alfred David Lenz system of lost wax casting. New York, National Sculpture Soc., 1933. $1.50.
Adams, C. W.	Your teeth and their care. St. Louis, Mosby, 1932. $1.25.
American Pharmaceutical Assn.	Pharmaceutical recipe book. Baltimore, Md., American Pharmaceutical Assn., 1929. $5.00.
Anderson, G. M.	Orthodontic laboratory manual. St. Louis, Mosby, 1930. $2.00.
Anthony, L. P.	Dental terminology. Chicago, American Dental Assn., 1930. (Free.)
Appleton, J. L. T., Jr.	Bacterial infection with special reference to dental practice. Philadelphia, Lea & Febiger, 1925. $6.00.
Appleton, J. L. T., Jr., & Bryant, C. K.	Laboratory guide in bacteriology. Philadelphia, Lea & Febiger, 1928. $2.75.
Bartels, H. A.	Outline of bacteriology. New York, W. A. Broder, 1929. $2.00.
Beck, Dorothy F.	Cost of equipping a dental office. Chicago, University of Chicago Press, 1932. $1.00.
Berger, Adolph	Principles and technique of oral surgery. Brooklyn, Dental Items of Interest Pub. Co., 1927. $7.00.
Berger, Adolph	Principles and technique of the removal of teeth. Brooklyn, Dental Items of Interest Pub. Co., 1929. $7.50.
Blunt, Katharine, & Cowan, Ruth	Ultraviolet light and vitamin D in nutrition. Chicago, University of Chicago Press, 1930. $2.50.
Bodecker, C. F.	Elementary histology for dental hygienists. New York, W. A. Broder, 1929. $2.00.
Bogert, L. J.	Nutrition and physical fitness. Philadelphia, Saunders, 1931. $3.00.
Bosworth, H. J.‡	Dental economics. Chicago, Bosworth Economic Institute, 1932. $10.00.
Bowler, Inez	Elementary manual of dental library practice. Ann Arbor, Univ. of Michigan Press, 1932.
Box, H. K.	Necrotic gingivitis. Toronto, University of Toronto Press, 1930. $1.00.
Box, H. K.	Treatment of the periodontal pocket. Toronto, University of Toronto Press, 1928. $1.00.
Bregstein, S. J.	Business conduct of an ethical practice. Brooklyn, Dental Items of Interest Pub. Co., 1932. $4.00.

*Books may be *borrowed* by members of the Association for a period of one week after date of receipt; and if not reserved for some one else, the period will be extended on request. A deposit of $2.00 for each volume to be sent at one time should accompany all requests for books. This will be refunded on return of books.

†If you wish to *purchase* books, indicate plainly which books you desire and enclose check with order.

‡At the time of going to press, there is a long list of reservations on this book. Those requesting it now should do so with the understanding that it will be some time before the book will be available.

Broderick, F. W.	Dental medicine. St. Louis, Mosby, 1928. $6.00.
Broderick, R. A.	Dental bacteriology. Outlines of dental science. Vol. 2. Edinburgh, Livingstone, 1926. $2.50.
Brothers, E. D.	Dental jurisprudence. St. Louis, Mosby, 1928. $2.25.
Brown, A. J.	Dental metallurgy. Outlines of dental science. Vol. 11. New York, Wood, 1928. $2.50.
Brown, W. L.	Endocrines in general medicine. St. Louis, Mosby, 1927. $3.00.
Buckley, J. P.	Modern dental materia medica, pharmacology and therapeutics. Philadelphia, Blakiston, 1926. $6.00.
Bulleid, Arthur	Textbook of bacteriology for dental students. St. Louis, Mosby, 1927. $4.50.
Bunce, E. W.	Bunce-Kanouse full denture technic. Chicago, Coe Laboratories, Inc., 1929. $1.25.
Bunting, R. W.	A textbook of oral pathology for students and practitioners of dentistry. Philadelphia, Lea & Febiger, 1929. $7.00.
Burchard, H. H., & Inglis, O. E.	Textbook of dental pathology and therapeutics for students and practitioners. Philadelphia, Lea & Febiger, 1926. $7.50.
Burkhart, H. J.	Care of the mouth and teeth. (National Health Series.) New York, Funk & Wagnalls, 1928. $.30.
Buxton, J. L. D.	Dental pathology. Outlines of dental science. Vol. 7. New York, Wood, 1927. $2.50.
Buxton, J. L. D.	Dental surgery. Outlines of dental science. Vol. 8. New York, Wood, 1927. $2.50.
Cahn, L. R.	Basic principles of general and oral pathology. Brooklyn, N. Y., Dental Items of Interest Pub. Co., 1929. $4.50.
Campbell, Menzies	Those teeth of yours. London, Heinemann, 1931. $1.50.
Casto, T. D.	Questions and answers on pedodontology, with glossary. Philadelphia, author, 1932. $2.50.
Cattell, Psyche	Dentition as a measure of maturity. Cambridge, Harvard University Press, 1928. $1.00.
Churchill, H. R.	Human odontography and histology. Philadelphia, Lea & Febiger, 1932. $4.50.
Clark, C. A.	Dental radiography. Outlines of dental science. Vol. 5. New York, Wood, 1926. $2.50.
Cogswell, W. W.‡	Dental oral surgery. Pittsburgh, Penna., Dental Digest, Inc., 1932. $10.00.
Colyer, J. F., & Sprawson, Evelyn	Dental surgery and pathology. New York, Longmans, 1931. $12.50.
Colyer, Stanley	Chronic infection of the jaws: a short radiological and clinical study. New York, Macmillan, 1926. $3.50.
Committee on Costs of Medical Care	Medical care for the American people. Chicago, Univ. of Chicago Press, 1932. $1.50.
Daukes, S. H.	Medical museum: Modern developments, organization and technical methods based on a new system of visual teaching. London, Wellcome Foundation, Ltd., n.d. (No purchase orders accepted.)
Davis, M. M.	Paying your sickness bills. Chicago, University of Chicago Press, 1931. $2.50.
Dental Board of the United Kingdom	Four lectures on "general anaesthesia." London, Dental Board of the United Kingdom, 1926. $1.25.
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Diamond, M.	Dental anatomy. A graphic presentation of tooth forms with an original technique for their reproduction. New York, Macmillan, 1929. $5.00.
Doxtater, L. W.‡	Procedures in modern crown and bridge-work. Brooklyn, N. Y., Dental Items of Interest Pub. Co., 1931. $8.00.

Endleman, Julio	Special dental pathology; a treatise for students and practitioners. St. Louis, Mosby, 1927. $7.00.
Ennis, L. M.	Dental roentgenology. Philadelphia, Lea & Febiger, 1931. $6.50.
Farkasch, O.	Dilemmas of dentistry. New York, Dodd Bros., 1931. $3.50.
Federspiel, M. N.	Harelip and cleft palate. St. Louis, Mosby, 1927. $5.00.
Felcher, F. R.	Art of porcelain in dentistry. St. Louis, Mosby, 1932. $9.00.
Feldman, M. H.	Manual of exodontia. Philadelphia, Lea & Febiger, 1930. $3.50.
Ferguson, H. W.	Child's book of the teeth. Yonkers-on-Hudson, World Book Co., 1932, $0.68.
Fine, Samuel	Principles and practice of dental assistant. Worcester, Mass., Hamilton Pub. Co., 1931. $2.50.
Fones, A. C.	Mouth hygiene; a textbook for dental hygienists. Philadelphia, Lea & Febiger, 1927. $5.00.
Fones, A. C.	Preventive dentistry. Philadelphia, Lea & Febiger, 1925. $2.75.
Foote, J. S.	Bone as a measure of development: When and how we acquired our teeth. Chicago, American Dental Association, 1928. $4.00.
Franzen, Raymond	Public health aspects of dental decay in children. New York, American Child Health Assn., 1930. $1.25.
Gies, W. J.	Dental education in the United States and Canada. New York, Carnegie Foundation, 1926. (Free.)
Gillett, H. W., & Irving, A. J.‡	Gold inlays by the indirect system. Brooklyn, Dental Items of Interest, 1932. $8.00.
Goepp, R. M.	Dental state board questions and answers. Philadelphia, Saunders, 1928. $4.50.
Goslee, H. J.	Principles and practice of crown and bridge-work. Brooklyn, Dental Items of Interest Pub. Co., 1926. $7.50.
Gottlieb, B., & Orban, B.	Die veränderungen der gewebe bei übermässiger beanspruchung der zähne. Leipzig, Georg Thieme, 1931. Unbound, $6.50. Bound, $7.00.
Graves, Lulu G.	Foods in health and disease. New York, Macmillan, 1932. $3.50.
Greenfield, A. L.	Interpretation of dental radiograms. Rochester, N. Y., Ritter Dental Mfg. Co., 1926. $2.50.
Gregory, W. K.	Our face from fish to man. New York, Putnam, 1929. $4.50.
Gwathmey, J. T.	Textbook of anesthesia. New York, Macmillan, 1929. $7.50.
Gwinn, C. D.	Textbook of exodontia. Philadelphia, Lea & Febiger, 1927. $2.75.
Gysi, Alfred	Special teeth for cross-bite cases. New York, Dentists' Supply Co., 1928. (Pamphlet.) (No purchase orders accepted.)
Hackh, I. W. D.	Chemical reactions and their equations. Philadelphia, Blakiston, 1928. $2.00.
Haden, R. L.	Dental infection and systemic disease. Philadelphia, Lea & Febiger, 1928. $2.50.
Hanau, R. L.	Dental engineering. Buffalo, N. Y., Author, 1926. (No purchase orders accepted.)
Hanau, R. L.	Hanau intraoral method vs. Gysi extraoral method. Buffalo, N. Y., Author, 1927. (No purchase orders accepted.)
Hartman, L. L.	Teeth and the mouth. New York, Appleton, 1927. $1.50.
Head, Joseph	Everyday mouth hygiene. Philadelphia, Saunders, 1925. $1.00.
Hedstrom, Gustav	Gangrene of dental pulp and its treatment. Stockholm, Sweden, Isaac Marcus, 1927. (No purchase orders accepted.)
Headridge, Davis, & Gibson, S. K.	Dental anatomy, human and comparative. Outlines of dental science. Vol. 6. New York, Wood, 1928. $2.50.
Herbst, Emil, & Apffelsteadt, Max	Atlas and grundriss der missbildungen der kiefer and zähne. München, J. F. Lehmanns, 1928. (No purchase orders accepted.)
Hertzler, E.	Technic of local anesthesia. St. Louis, Mosby, 1925. $5.50.
Hess, Walter, & Zurcher, Ernst	Anatomy of the root-canals of the teeth. New York, Wood, 1925. $5.50.
Hewer, C. L.	Recent advances in anaesthesia and analgesia. Philadelphia, Blakiston, 1932. $3.50.

Hildebrand, G. Y.	Studies in masticatory movements of human lower jaw. Berlin, Gruyter, 1931. (No purchase orders accepted.)
Hodgen, J. D.	Practical dental metallurgy. St. Louis, Mosby, 1932. $3.75.
Hogeboom, F. E.	Practical pedodontia or juvenile operative dentistry and public health dentistry. St. Louis, Mosby, 1927. $3.50.
Hyatt, T. P.	Hygiene of mouth and teeth. Brooklyn, N. Y., Brooklyn Dental Pub. Co., 1929. $1.00.
Ivy, R. H., & Curtis, Lawrence	Fractures of the jaws. Philadelphia, Lea & Febiger, 1931. $4.50.
Jamieson, J. D. H.	Operative dentistry. Outlines of dental science. Vol. 9. New York, Wood, 1927. $2.50.
Jerman, E. C.	Modern x-ray technic. St. Paul, Bruce Pub. Co., 1928. $5.50.
Jordan, E. O.	Textbook of general bacteriology. Philadelphia, Saunders, 1931. $6.00.
Jordan, M. Evangeline	Operative dentistry for children. Brooklyn, Dental Items of Interest Pub. Co., 1927. $5.00.
Kanner, Leo	Folklore of the teeth. New York, Macmillan, 1928. $4.00.
Kells, C. E.	Dentists' own book, including a complete bookkeeping and recording system. St. Louis, Mosby, 1925. $7.50.
Kells, C. E.	Three score years and nine. New Orleans, The Author, 1926. $8.00.
Kennedy, Edward	Partial denture construction. Brooklyn, N. Y., Dental Items of Interest Pub. Co., 1928. $7.50.
Kent, E. N.	Business side of dentistry. St. Louis, Mosby, 1929. $5.00.
Korkhaus, Gustav	Moderne orthodontische therapie. Berlin, Meusser, 1932.
LeGro, A. L.	Ceramics in dentistry. Brooklyn, N. Y., Dental Items of Interest Pub. Co., 1926. $7.50.
Leriche, R., & Policard, A.	Normal and pathological physiology of bone. St. Louis, Mosby, 1928. $5.00.
Kronfeld, Rudolf	Histopathology of the teeth and their surrounding structures. Philadelphia, Lea & Febiger, 1933. $7.00.
Leuck, Miriam S.	Study of dental clinics in the United States: 1930. Chicago, University of Chicago Press, 1932. $1.00.
Leuck, Miriam S.	Further study of dental clinics in the United States. Chicago, University of Chicago Press, 1932. $1.50.
Leven, Maurice, & Beck, Dorothy F.	Practice of dentistry and incomes of dentists in twenty states: 1929. Chicago, University of Chicago Press, 1932. $2.00.
Livingston, Alexander	Dental histology. Outlines of dental science. Vol. 10. New York, Wood, 1928. $2.50.
Lloyd-Williams, E.	Dental mechanics: a manual for students and junior practitioners. London, Bale, 1931. $2.00.
Logan, J. D.	Dental prosthetics. Outline of dental science. Vol. 4. Edinburgh, Livingstone, 1926. $2.50.
Margolis, H. M.	Conquering arthritis. New York, Macmillan, 1932. $2.00.
Marriott, W. M.	Infant nutrition: a textbook of infant feeding for students and practitioners of medicine. St. Louis, Mosby, 1930. $5.50.
Marsden, P. H.	Dental materia medica. Outlines of dental science. Vol. 3. Edinburgh, Livingstone, 1926. $2.50.
Marshall, J. A.	Diseases of the teeth; their diagnosis and treatment. Philadelphia, Lea & Febiger, 1926. $4.50.
Maximow, A. A., & Bloom, Wm.	Textbook of histology. Philadelphia, Saunders, 1930. $9.00.
McBride, W. C.	Juvenile dentistry. Philadelphia, Lea & Febiger, 1932. $2.75.
McCaw, Emma J.	Dental assistant. St. Louis, Mosby, 1926. $1.50.
McCollum, E. V., & Simmonds, Nina	Food, nutrition and health. Baltimore, Authors, 1928. $1.50.
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Okumura, Tsurukichi Present status of dentistry in Japan. Tokyo, Japan, Japan Dental Assn., 1931. (Pamphlet.) (No purchase orders accepted.)

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Pollia, J. A. Fundamental principles of alveolo-dental radiology. Brooklyn, Dental Items of Interest Pub. Co., 1930. $8.00.

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Prinz, Hermann Dental formulary. Philadelphia, Lea & Febiger, 1930. $3.50.

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Pusey, W. A. Doctor of the 1870's and 1880's. Baltimore, C. C. Thomas, 1932. $3.00.

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Rapp, F. W. Elements of anatomical articulation or the mathematics of dental prosthetics. London, Bale, 1930. $2.00.

Ray, K. W. Metallurgy for dental students. Philadelphia, Blakiston, 1931. $3.00.

Report of Committee on Growth and Development Growth and development of the child. Part III. Nutrition. (A publication of White House Conference on Child Health and Protection.) New York, Century, 1932. $4.00.

Report of Committee on Public Health Organization Public health organization. (A publication of White House Conference on Child Health and Protection.) New York, Century, 1932. $3.00.

Reports of Subcommittees on Nutrition and Health Centers Nutrition service in the field. Child health centers: a survey. (A publication of White House Conference on Child Health and Protection.) New York, Century, 1932. $2.00.

Roberts, Lydia J. Nutrition work with children. Chicago, University of Chicago Press, 1927. $3.50.

Rose, Mary S. Foundations of nutrition. New York, Macmillan, 1927. $2.75.

Rukeyser, M. S. Doctor and his investments. Philadelphia, Blakiston, 1931. $2.50.

Schroff, Joseph Fundamentals of pathology. New York, W. A. Broder, 1929. $2.50.

Sears, V. H.	Full denture procedure. New York, Macmillan, 1929. $2.00.
Shaw, D. M.	Dental prosthetic mechanics. London, Arnold, 1927. $7.50.
Sherman, H. C.	Vitamins. New York, Chemical Catalogue Co., Inc., 1931. $6.00.
Sicher, Harry, & Tandler, Julius	Anatomie für Zahnärzte. Vienna, Julius Springer, 1928. (No purchase orders accepted.)
Silverman, S. L.	Principles and practice of oral surgery. Philadelphia, Blakiston, 1926. $6.00.
Simon, P. W.	Fundamental principles of systematic diagnosis of dental anomalies. Boston, Stratford, 1926. $5.00.
Simon, W., & Base, Daniel	Manual of chemistry. Philadelphia, Lea & Febiger, 1927. $5.00.
Simons, A. M., & Sinai, Nathan	Way of health insurance. Chicago, University of Chicago Press, 1932. $2.00.
Simpson, C. O.	Advanced radiodontic interpretation. St. Louis, University Press, 1931. $35.00. (Because of the unusual price and its lack of durability a rental fee of $1.00 will be charged for this book for each two weeks it is in circulation.)
Simpson, C. O.	Technic of oral radiography. St. Louis, Mosby, 1928. $5.00.
Smith, D. T.	Oral spirochetes and related organisms in fusospirochetal disease. Baltimore, Williams & Wilkins, 1932. $4.50.
Smith, G. F. R.	Dental anaesthesia. Outlines of dental science. Vol. 1. Edinburgh, Livingstone, 1926. $2.50.
Smyth, Corisande, & Young, Matthew	Facial growth in children. London, His Majesty's Stationery Office, 1932. $0.75.
Sorrin, Sidney, & Miller, S. C.	Practice of periodontia. New York, Macmillan, 1928. $3.50.
Steadman, F. St. J.	Pyorrhea alveolaris. St. Louis, Mosby, 1927. $9.25.
Stieglitz, Julius	Chemistry in medicine. New York, Chemical Foundation, 1928. $2.00.
Stillman, P. R., & McCall, J. O.	Textbook of clinical periodontia. New York, Macmillan, 1927. $4.50.
Stillson, W. C.	Dental anatomy: classroom and laboratory quiz compend with supplementary notes. Philadelphia, Saunders, 1929. $2.25.
Stoloff, C. I.	Your teeth. New York, Dutton, 1929. $2.50.
Suter, A. B. W.	Dentistry—a profession and a business. Rochester, N. Y., Ritter Dental Mfg. Co., 1930. $7.50.
Tanguy, T. V.	Science and practice of actinotherapy. St. Louis, Mosby, 1928. $3.00.
Toverud, K. U., & Toverud, Guttorm	Studies on the mineral metabolism during pregnancy and lactation and its bearing on the disposition to rickets and dental caries. Uppsala, Almqvist & Wiksells Boktryckeri-A-B, 1931. (Pamphlet.) (No purchase orders accepted.)
Turner, C. R., & Anthony, L. P.‡	American textbook of prosthetic dentistry. Philadelphia, Lea & Febiger, 1932. $10.00.
Tyree, C.	Dental health in the prevention of disease. London, Kentucky, Author, 1927. $2.75.
Urling, L. H.	Your teeth; their care and preservation. Philadelphia, Dorrance, 1932. $1.50.
Wallace, J. S.	Physiology of oral hygiene and recent research. London, Bailliere, Tindall & Cox, 1929. $4.00.
Wallace, J. S.	Teeth and health. London, Faber & Gwyer, 1926. $1.00.
Wallace, J. S.	Variations in the form of the jaws, with special reference to their etiology and their relation to the occlusion of the dental arches. New York, Wood, 1926. $6.00.
Ward, L.	American textbook of operative dentistry. Philadelphia, Lea & Febiger, 1926. $10.00.
Webster, A. E.	Manual for dental assistants. Philadelphia, Lea & Febiger, 1932. $3.50.

Weinberger, B. W.	Orthodontics: an historical review of its origin and evolution. 2 vols. St. Louis, Mosby, 1926. $25.00.
William, Maurice	Sun Yat-Sen versus communism. New evidence establishing China's right to the support of democratic nations. Baltimore, Williams & Wilkins, 1932. $5.00.
Williams, Pierce, & Chamberlain, Isabel	Purchase of medical care through fixed periodic payment. New York, National Bureau Economic Research, 1932. $3.00.
Winter, G. B.	Principles of exodontia, as applied to the impacted mandibular third molar. St. Louis, American Medical Book Co., 1926. $15.00.
Winter, Leo	Textbook of exodontia. St. Louis, Mosby, 1931. $10.00.
Wolfenden, H. H.	Real meaning of social insurance. Toronto, Canada, Macmillan, 1932. $2.00.
Woodbury, C. E.	Making and filling of cavities in the proximal surface of the front teeth with gold foil. Omaha, Neb., Author, 1929. $5.00.
Zemsky, J. L.	Oral diseases: practical treatise offering diagnostic and therapeutic aid to the practitioner of medicine and dentistry. Brooklyn, N. Y., Physicians and Surgeons Book Co., 1930. $8.00.
Zemsky, J. L.	Outline of oral surgery. Brooklyn, N. Y., Physicians and Surgeons Book Co., 1930. $4.50.
Zoethout, W. D.	Textbook of physiology. St. Louis, Mosby, 1928. $4.50.

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